REV C

DOCUMENT NUMBER 570-7000

PURPOSE:

This document is the Installation Manual for the AIU-1.

INSTALLATION MANUAL

for the

AIU-1 ANALOG INTERFACE UNIT

CHELTON FLIGHT SYSTEMS

REVISION HISTORY FOLLOWS ON PAGE 4.

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APPROVALS	SIGNATURE	DATE
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ANALOG INTERFACE UNIT (AIU-1) INSTALLATION MANUAL

SIZE	CAGE CODE	DOCUMENT NUMBER	REV
A	XXXX	570-7000	C
	SCALE: NONE	DO NOT SCALE DRAWING	

DCN 2410

Typed signatures indicate approval.
Handwritten signature approval of this document is on file at Artex Aircraft Supplies, Aurora, OR.

CHELTON
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REVISION HISTORY

AIU Installation Manual, Document 570-7000

REV	DESCRIPTION	DATE	APPROVED
C	Per DCR 3101 1. Modified environmental qualification section 4.0 in Chapter 1 2. Modified Autopilot Interface section in Chapter 2 to calculate for AC-rms and added additional examples 3. Added 5.897X and 11.12X capability for AC Datums and Bendix/King KFC-225, KFC-325, KFC-250, Cessna 1000, Collins APC-65A, AP-106, FCS-80, Honeywell SPZ-500, and S-Tec 65 autopilot interfaces to Chapter 2 and wiring diagrams in Chapter 3 4. Added Bendix/King KFC-300, S-Tec 20/30/30ALT, and SPZ-200 autopilot interface in Chapter 2 and Chapter 3 5. Corrected pin assignment of KFC-150 wiring diagram in Chapter 3 6. Modified Ground Functional Tests 7.20, 7.23, 8.17, and 8.20 for ILS testing at 0.093DDM and 0.155DDM deflection 7. Modified Glideslope Cancel Option A label to "Mom PB Switch" in Section 3.5.	6/9/04	D. Q
B	Per DCR 2936 1. Added additional TSO applicability in Chapter 1 2. Added additional mounting requirements in Chapter 2 3. Modified Autopilot Interface section of Chapter 2 4. Corrected AC Course Isolation pin outs of Chapter 2 5. Modified Flight Director Interface section of Chapter 2 6. Added Flight Director Setup section in Chapter 2 7. Corrected pin descriptions on P1 Connector page of Chapter 3 8. Corrected pin labels on Autopilot Command Out wiring diagram in Chapter 3 9. Corrected connector label on ADF interconnect wiring diagram in Chapter 3 10. Corrected pin labels on HDG and CRS output pins for 400 and 5KHz wiring diagrams in Chapter 3 11. Added Flight Director Null description in Chapter 4 12. Modified Heading Gain Flight Test Procedures in Chapter 6 13. Added Course Gain Flight Test Procedures in	11/5/03	D. Salt

REV	DESCRIPTION	DATE	APPROVED
	Chapter 6.		
A	Reissue Page 50 per DCR 2900	10/07/03	D. Friesen
A	Initial Release	9/24/03	D. Friesen

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Chapter 1

Introduction

ABOUT THIS GUIDE

This guide provides instructions for installing the Chelton Flight Systems Analog Interface Unit (AIU). Use it for new or retrofit installations. The most recent version of this installation guide is always available online at www.cheltonflightsystems.com.

WARNING!
These instructions are intended for use by installers familiar with standard aircraft avionics practices and methods of installation. If you do not have prior experience with or knowledge of avionics installations, do not attempt the following installation. Chelton Flight Systems will not be held liable for damaged items resulting from improper handling and installation.

You will find the stylistic elements listed in **Table 1** used throughout this guide. These styles are used to emphasize text, to make the information more accessible to you during the installation, and to make the online manual more interactive.

This guide includes installation and checkout procedures for the AIU to standards described in FAA Advisory Circular 23-1311-1A.

Chapter 1	Provides an **introduction** to the AIU and includes a description of the AIU, parts list and list of special tools required.
Chapter 2	Includes **system installation** and AIU pin assignments.
Chapter 3	Includes **system drawings**, both mechanical and electrical.
Chapter 4	Includes **AIU configuration** program.
Chapter 5	Includes **ground functional test** procedures.
Chapter 6	Includes **flight functional test** procedures.

Chapter 7 Includes **troubleshooting** information.

Table 1 Installation Guide Style Conventions

Style	Description	Uses
1. Tasks	Numbered steps that together form a set of instructions for installing a specific EFIS component.	The numbered task guides you through the proper sequence of installation procedures.
Checklists ÿ	Installation procedures with checkboxes beside them. All the procedures in the checklist must be performed, but do not need to be performed in a specific order.	The checklist will help you track your installation progress. Write a checkmark in the checkbox after you complete each procedure.
NOTE:	Italicized text with black borders.	The note format is used to highlight and further explain certain installation and operational details.
WARNING! 	A graphical icon with an explanation point in the center, followed by bolded text with red borders.	This warning icon is used to flag important installation considerations. Failure to heed the information in the warnings could cause bodily harm, damage to the aircraft, or damage to the EFIS product.

UNPACKING THE AIU

System components are shipped in packaging designed to protect the components during transit. Carefully unpack and identify each component using the list on page 12. Check the contents of the package against the packing list in the box. Visually inspect each individual component for any signs of damage.

Keep all shipping containers and packaging in case you need to return any items. Contact Chelton Flight Systems immediately if you find missing or damaged components. Before returning anything, please contact Chelton Flight Systems by one of the means below.

Phone: (208) 389-9959
Fax: (208) 389-9961
E-mail:support@cheltonflightsystems.com

You must file a claim for a damaged product within 48 hours of receiving the equipment.

Most of the items required for installation are supplied in the original package from Chelton Flight Systems. You may order supplemental items (not included in the package) from Chelton Flight System separately to further aid the installation process.

SPECIAL TOOLS

In addition to a standard aircraft mechanic's tool set, you will need crimp tools and locators that meet MIL specification M22520. These tools will ensure consistent, reliable crimp contact connections. If you do not have these specialized tools, contact Chelton Flight Systems for sourcing information. Refer to **Table 2** below for specifications.

Table 2 Special Tools Parts List

Tool Description	Part Number
Crimp Tool	M22520/2-01
Locator	M22520/2-06
Locator	M22520/2-08
Locator	M22520/2-09
Insert/Removal	M81969/1-02
Insert/Removal	M81969/1-04

You should also have the following tools and supplies on hand:

- Loctite® 242 Medium Strength Threadlocker for sensors and probes.
- A digital multimeter for testing internal terminators on cable assemblies, and for testing voltage of various outputs.
- Laptop computer with the AIU Maintenance program loaded.
- RS-232 serial cable for connecting the laptop computer to the AIU maintenance plug.

SYSTEM DESCRIPTION

The Chelton Flight Systems AIU provides a data conversion function for the Chelton Flight Systems EFIS system. The unit receives inputs from navigation receivers, radar altimeters, marker beacon receivers, and autopilots, and translates them to digital data that is sent to the EFIS. The AIU also translates digital autopilot commands from the EFIS to analog steering signals that allow the EFIS to command an aircraft autopilot.

The AIU interface consists of two composite-Nav inputs, two Glideslope deviation inputs, a scaleable analog radar altimeter input, an ADF XYZ or ADF DC Sin/Cosine input, a flight director input, two ARINC-429 receivers, four RS-232 receivers, and eight discrete line inputs. The AIU also contains an autopilot left/right deviation output, heading and course datum outputs, deviation valid flag output, one ARINC-429 transmitter, four RS-232 transmitters, and one discrete line output.

The main function of the AIU is to provide the EFIS converted analog signals and to provide a means for the EFIS to control legacy analog autopilots. The AIU also brings in several discrete signals for Terrain Awareness Warning System (TAWS) requirements.

SYSTEM CONFIGURATION

The AIU contains a power supply, a digital signal processor, analog input/output (I/O) conditioners, and digital data I/O. The power supply provides conditioned voltages to all components in the AIU.

The digital signal processor performs the analog-to-digital (A/D) and digital-to-analog (D/A) conversions and interfaces with the ARINC and RS-232 drivers as determined by the software stored in its internal memory.
The analog I/O conditioners consist of: two VOR/LOC composite decoders, two glideslope deviation converters, a radar altimeter converter, a flight director vertical and lateral deviation converter, a DC sin/cosine converter, an ARINC-407 ADF XYZ converter, an autopilot course and heading datum generator, a left/right deviation generator, eight discrete input converters, and one discrete output.

The digital I/O consists of two ARINC-429 receivers, one ARINC-429 transmitter, four RS-232 receivers and four RS-232 transmitters.

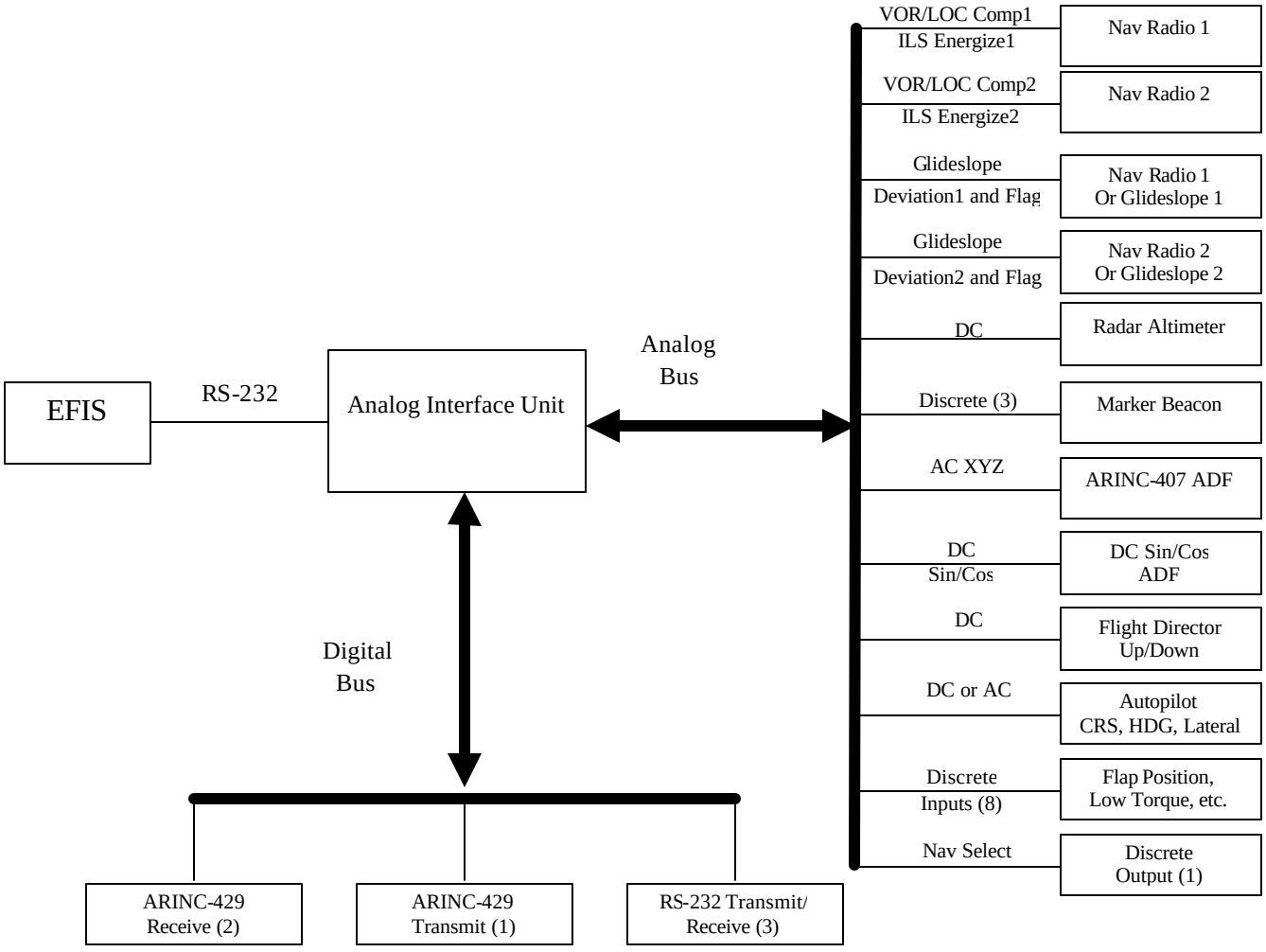


Figure 1 Block Diagram AIU System

SYSTEM COMPONENTS AND SPECIFICATIONS

The tables below describe the AIU and components of the installation kit provided with the unit.

Table 3. System Components and Specifications

Component	Description	Part No.	Specifications		
			Dimensions	Weight	Power
	Analog Interface Unit (AIU)	453-7000	5.05”w 3.08”h 8.12”d	2.2 lbs.	10-34VDC 0.5 Amps

Table 4. AIU Installation Kit, 455-0050

QTY	REFERENCE	DESCRIPTION	ITEM	ARTEX P/N
1	CON62F	CONNECTOR, D-SUB, 62 PIN-F	P1	150-6200
1	BACK62	BACKSHELL	P1	151-6764
1	CON44M	CONNECTOR, D-SUB, 44 PIN-M	J3	150-4400
1	BACK44	BACKSHELL	J3	151-6763
1	CON15HDF	CONNECTOR, D-SUB 15 PIN-F	P2	150-1500
1	BACK15	BACKSHELL	P2	151-6761
1	INSERT	INSERT/REMOVAL TOOL 22GA		145-0671
1	CON09M	CONNECTOR, D-SUB 9 PIN-M	P4	150-0900
1	SWTOGMOM	SWITCH, SPST. MOMENTARY	S9508	140-0008
1	PLACARD	PLACARD, G/S CANCEL		591-0060

AIU ENVIRONMENTAL QUALIFICATION

The AIU meets the following environmental testing requirements from DO-160D:

Table 5. AIU Environmental Qualifications

Sec.	*Condition*	*Cat.*	*Test Category Description*	*Notes*
4.0	Temperature and Altitude	D3	Equipment intended for installation in non-pressurized and non-controlled temperature location in an aircraft that is operated at altitudes up to 50,000 ft (15,200 m) MSL.	Operating Low Temp, Para 4.5.1 at -55°C with exception for LOC flag function to -20°C; Operating High Temp, Para 4.5.3 at +55°C; Short-Time Operating High Temp, P ara 4.5.2 at +55°C; Loss of Cooling Test, Para 4.5.4 at +30°C; Ground Survival Low Temp, Para 4.5.1 at -55°C; Ground Survival High Temp, Para 4.5.2 at +85°C.
4.5.4	Loss of Cooling	X	Equipment intended for installation in non-pressurized and non-controlled temperature location in an aircraft that is operated at altitudes up to 50,000 ft (15,200 m) MSL.	Equipment requires no auxiliary cooling.
5.0	Temperature Variation	B	Equipment in a non-temperature-controlled internal section of the aircraft.	
6.0	Humidity	B	Equipment intended for installation in civil aircraft, non-civil transport aircraft and other classes, within non-environmentally controlled compartments of aircraft in which more severe humidity environment may be encountered.	
7.0	Operational Shocks & Crash Safety	B	Equipment generally installed in fixed-wing aircraft or helicopters and tested for standard operational shock and crash safety.	Level 5 for Crash Safety Sustained Test
8.0	Vibration	T + U	T - (Fixed-Wing) Demonstrates performance at higher vibration levels and after long term vibration exposure. It also demonstrates performance during high level - short duration vibration. U - (Helicopter w/Unknown Frequencies) Demonstrates performance at higher vibration levels and after long term vibration exposure for fuselage and instrument panel equipment when the specific rotor frequencies are unknown.	
15.0	Magnetic Effect	Z	Magnetic deflection distance less that 0.3m.	
16.0	Power Input	B	Equipment intended for use on aircraft electrical systems supplied by engine-driven alternator/rectifiers, or dc generators where a battery of significant capacity is floating on the dc bus at all times.	
17.0	Voltage Spike	A	Equipment intended primarily for installation where a high degree of protection against damage by voltage spikes is required.	
18.0	Audio Frequency Conducted Susceptibility-Power Inputs	B	Equipment intended for use on aircraft electrical systems supplied by engine-driven alternator/rectifiers, or dc generators where a battery of significant capacity is floating on the dc bus at all times.	
19.0	Induced Signal Susceptibility	C	Equipment intended primarily for operation in systems where interference-free operation is required and where severe coupling occurs due to long wire runs or minimum wire separation.	
20.0	Radio Frequency Susceptibility	W	Equipment and interconnecting wiring installed in severe electromagnetic environments. Such environments might be found in non-metallic aircraft or exposed areas in metallic aircraft.	

Sec.	*Condition*	*Cat.*	*Test Category Description*	*Notes*
21.0	Emission of Radio Frequency Energy	M	Equipment and interconnected wiring located in areas where apertures are EM significant and not directly in view of the radio receiver's antenna. This category may be suitable for equipment and associated interconnecting wiring located in the passenger cabin or cockpit of a transport aircraft.	
22.0	Lightning Induced Transient Susceptibility	A3G33	Equipment interconnected with wiring installed within airframes or airframe sections where apertures, not structural resistance, are the main source of induced transients as would be the case in all-metal airframes, airframes composed of metal framework and composite skin panels or carbon fiber composite airframes whose major surface areas have been protected with metal meshes or foils. Level 3 designates equipment and interconnecting wiring installed in a moderately exposed environment.	Cat. A pin injection tests. Cat. G cable bundle single stroke, multiple stroke, and multiple burst tests. Tested by similarity.
25.0	Electrostatic Discharge	A	Electronic equipment that is installed repaired or operated in an aerospace environment.	

AIU TSO APPLICABILITY

The AIU meets the following TSO requirements:

Table 6. AIU TSO Applicability

TSO	Title	MOPS
TSO-C34e	ILS Glide Slope Receiving Equipment Operating Within the Radio Frequency Range of 328.6-335.4 MHz (partial)	RTCA/DO-192
TSO-C35d	Airborne Radio Marker Receiving Equipment (partial)	RTCA/DO-143
TSO-C36e	Airborne ILS Localizer Receiving Equipment Operating Within the Radio Frequency Range of 108-112 MHz (partial)	RTCA/DO-195
TSO-C40c	VOR Receiving Equipment Operating Within the Radio Frequency Range of 108-117.95 MHz (partial)	RTCA/DO-196
TSO-C41d	Airborne Automatic Direction Finding (ADF) Equipment (partial)	RTCA/DO-179
TSO-C52b	Flight Director Equipment (partial)	SAE AS8008
TSO-C87	Airborne Low-Range Radio Altimeter (partial)	RTCA/DO-155
TSO-C146a	Stand-Alone Airborne Navigation Equipment Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS) (partial)	RTCA/DO-229C

Chapter 2

System Installation

INSTALLATION OVERVIEW

Installation will typically follow these steps, which are explained in detail later in this chapter:

1. Perform a pre-mod avionics system check to verify that all interfaced avionics are functioning properly.

2. Determine the appropriate location for the AIU and make any necessary airframe modifications.

3. Route composite Nav and glideslope from No. 1 Nav system (if installed) to AIU.

4. Route composite Nav and glideslope from No. 2 Nav system (if installed) to AIU.

5. Route Marker Beacon wires from audio panel or marker beacon receiver (if installed) to AIU.

6. Route wiring from ADF (if installed) to AIU.

7. Route Radar Altimeter wiring (if installed) to AIU.

8. Route wiring from AIU to aircraft autopilot (if installed).

9. Route wiring from aircraft autopilot flight director to AIU (if installed).

10. Discrete switch interfacing as required.

11. Annunciated switch interfacing as required.

Task 1. Pre-mod Avionics Systems Check

Perform a pre-modification avionics system check of all interfaced equipment. Verify that all systems are functioning properly in accordance with the applicable aircraft maintenance manuals. If any discrepancies are noted, generate the appropriate paper work and record these discrepancies.

Task 2. Determine the Location of the AIU

The AIU should be installed as close to the existing navigation equipment as practical. This will reduce signal losses and potential external interferences that longer wire runs are susceptible to.

The AIU can be mounted vertically or horizontally by using the appropriate mounting holes located on the end plates of the unit. Upon determination of a suitable existing shelf, or completion of a new equipment shelf, a static load test must be performed per AC 43.13-2A, Chapter1, §2 and §3 to determine proper load bearing and security of the equipment. A typical aircraft operating in Normal FAR 23 (CAR 3) category will require a test of the shelf as follows:

Direction of Pull	**Load Factor**	**Static Test Load** (***Load factor x AIU Weight***)
Sideways	1.5g	(1.5 x 2.2) = 3.3 Lbs
Upwards	3.0g	(3.0 x 2.2) = 6.6 Lbs
Forwards	9.0g	(9.0 x 2.2) = 19.8 Lbs
Downwards	6.6g	(6.6 x 2.2) = 14.5 Lbs

The installer will make a simple test jig that will be used to measure the static test loads as shown in the table above. Perform the tests at the center of gravity of the AIU and record the completion of the test in the Ground Maintenance section of this manual. An acceptable installation will show no signs of permanent deformation after 3 seconds of applied pressure in all directions of pull.

Mount the AIU in accordance with drawing 3.1 of Chapter 3. Use a minimum of four 8-32 screws (MS27039-0807) and four #8 washers (NAS1149F0832P) or equivalent with installer supplied nuts, nut clips, or nut plates as required.

Task 3. Install AIU Cable Assembly

Fabricate the AIU cable assembly using the wiring diagrams in Chapter 3, drawings 702-045250, and 702-045251. The cable assembly will vary depending on the navigation interface, autopilot interface, and class of TAWS required for the installation.

Power and Ground

The AIU operates from 10 to 30VDC.

Label	J2	Description
POWER	1	10 TO 30VDC
POWER	6	10 TO 30 VDC
GROUND	2	MAIN GROUND
GROUND	7	MAIN GROUND
Label	**P3**	**Description**
14VDC POWER	18	10 TO 14VDC
28VDC POWER	19	22 TO 28VDC
GROUND	7	MAIN GROUND

CAUTION: *ConnectJ3 power to either 14VDC or 28VDC input, but not both.*

Additional Grounds

Label	J1
GROUND	3
GROUND	9
GROUND	20
GROUND	33
GROUND	46
GROUND	50
GROUND	51
GROUND	53
GROUND	62
Label	**P3**
GROUND	8
GROUND	15

Serial Communications

AIU Main Communication Port

The main communication port from the AIU to the EFIS is on Com1 (RS-232). See drawing 701-045250 and AIU wiring (Chapter 3) for additional information on AIU to EFIS interfacing.

Label	J1	Description
COM 1 TX	23	TO EFIS
COM 1 RX	22	FROM EFIS
COM 1 GND	44	GND

AIU Maintenance Port

The AIU is programmed by connecting the Com2 (RS-232) port of the AIU to a computer serial port. Refer to the AIU Maintenance section Chapter 4.

NOTE: *AIU Maintenance plug should be mounted in the flight compartment for access during flight as described in Chapter 6.*

Label	J1	Description
COM 2 TX	26	TO MAINT
COM 2 RX	25	FROM MAINT
COM 2 GND	24	GND

ARINC-429

There are two ARINC-429 receive and one ARINC-429 transmit ports. These input ports are not defined at this time.

Label	J1	Description
COM 6 RXA (+)	1	UNDEFINED
COM 6 RXB (-)	2	UNDEFINED
COM 5 RXA (+)	4	UNDEFINED
COM 5 RXB (-)	5	UNDEFINED
COM 5 TXA (+)	7	OUTPUT DATA
COM 5 TXB (-)	8	OUTPUT DATA

RS-232

There are four RS-232 transmit and receive ports. One is the main communications port to the EFIS, one is the ground maintenance port for alignment and setup and two are undefined at this time.

Label	J1	Description
COM 3 TX	29	UNDEFINED
COM 3 RX	28	UNDEFINED
COM 3 GND	27	GND
COM 4 TX	32	UNDEFINED
COM 4 RX	31	UNDEFINED
COM 4 GND	30	GND

Nav 1 Interface

The Nav 1 interface consists of one or more of the following:

Composite VOR/LOC

VOR signal consisting of a 9960 Hz carrier frequency at a nominal signal level of 0.5 VRMS ±0.05 VRMS which is AM modulated at 30 Hz and FM modulated at 30 Hz.

LOC signal consisting of a mixed 90 Hz and 150 Hz signal at a nominal signal level of 0.35 VRMS ±0.035 VRMS.

Label	J1	Description
COMPOSITE 1	37	COMPOSITE VOR/LOC NAV 1
COMPOSITE 1 LOW	36	COMPOSITE VOR/LOC LOW

ILS Energize

ILS Energize signal is ground for valid.

Label	J1	Description
ILS ENERGIZE 1	13	ILS ENERGIZE NAV 1

Glideslope Deviation

Glideslope deviation input provides full-scale deflection of ±150mV with an impedance of 1000 ohms. An input of +75mV ±1.171mV will provide a one-dot deflection.

Label	J1	Description
GLIDESLOPE 1 +UP	54	150MV GS1 UP
GLIDESLOPE 1 +DN	55	150MV GS1 DN

Glideslope Flag

A valid glideslope will be sensed when the input is at 375mV ±80mV at 1000 ohms of impedance. A flagged condition will be sensed when the input is at 0v ±25mV.

Label	J1	Description
GLIDESLOPE 1 +FLAG	58	GS1 FLAG
GLIDESLOPE 1 –FLAG	59	GS1 FLAG

Nav 2 Interface

The Nav 2 Interface is the same as the Nav 1 interface with respect to signal inputs. Nav 2 can contain composite VOR/LOC, glideslope, or both.

Label	J1	Description
COMPOSITE 2	38	COMPOSITE VOR/LOC NAV 2
COMPOSITE 2 LOW	19	COMPOSITE VOR/LOC LOW
ILS ENERGIZE 2	14	ILS ENERGIZE NAV 2
GLIDESLOPE 2 +UP	56	150MV GS2 UP
GLIDESLOPE 2 +DN	57	150MV GS2 DN
GLIDESLOPE 2 +FLAG	60	GS2 FLAG
GLIDESLOPE 2 –FLAG	61	GS2 FLAG

ILS Energize and Glideslope Select

Selection of Glideslope 1/2 and ILS Energize 1/2 is accomplished on AIU J3. The G/S SELECT OUT line from AIU P1 to AIU J3 GLIDESLOPE 1/2 sets the logic for autopilot drive.

Label	J1	Description
G/S SELECT OUT	45	G/S 1 / G/S 2 SELECT

When the G/S SELECT is open, the Glideslope 1 Up/Down, Flag, and ILS Energize 1 are passed to the autopilot. When the G/S SELECT is ground, the Glideslope 2 Up/Down, Flag, and ILS Energize 2 are passed to the autopilot.

Label	P3	Description
GLIDESLOPE 1/2	20	FROM P1, PIN 45
GLIDESLOPE 1 +UP	23	FROM GLIDELSOPE 1 +UP
GLIDESLOPE 2 +UP	25	FROM GLIDESLOPE 2 +UP
GLIDESLOPE +UP OUT	21	TO AUTOPILOT +UP
GLIDESLOPE 1 +DN	24	FROM GLIDESLOPE 1 +DN
GLIDESLOPE 2 +DN	26	FROM GLIDESLOPE 2 +DN
GLIDESLOPE +DN OUT	22	TO AUTOPILOT +DN
GLIDESLOPE 1 +FLAG	32	FROM GLIDESLOPE 1 +FLAG
GLIDESLOPE 2 +FLAG	34	FROM GLIDESLOPE 2 +FLAG
GLIDESLOPE +FLAG OUT	30	TO AUTOPILOT +FLAG
GLIDESLOPE 1 –FLAG	33	FROM GLIDESLOPE 1 –FLAG
GLIDESLOPE 2 –FLAG	35	FROM GLIDESLOPE 2 –FLAG
GLIDESLOPE –FLAG OUT	31	TO AUTOPILOT –FLAG
ILS ENERGIZE 2	38	FROM NAV1 ILS ENERGIZE
ILS ENERGIZE 1	40	FROM NAV2 ILS ENERGIZE
ILS ENERGIZE OUT	36	TO AUTOPILOT ILS ENERGIZE
SPARE A	39	NC
SPARE B	41	NC
SPARE OUT	37	NC

Marker Beacon Interface

The marker beacon input will be sensed as valid when the input exceeds a programmable level from the AIU Ground Maintenance functions (+3.0vdc default). The marker beacon logic can be configured as active high or active low. Only one marker beacon input will be considered active at any time.

Label	J1	Description
MARKER BLUE	10	OUTER MARKER
MARKER WHITE	11	INNER MARKER
MARKER YELLOW	12	MIDDLE MARKER

If the marker beacon receiver uses an active low (ground) to signal a valid light, then the optional wiring of AIU J3 is required to maintain a voltage on the pins until the receiver sends a valid state.

Label	J3	Description
MARKER BLUE PWR	27	5-28VDC EXCITATION, BLUE
MARKER BLUE	28	CONNECTED TO P1, PIN 10
MARKER WHITE PWR	29	5-28VDC EXCITATION, WHITE
MARKER WHITE	44	CONNECTED TO P1, PIN 11
MARKER YELLOW PWR	42	5-28VDC EXCITATION, YELLOW
MARKER YELLOW	43	CONNECTED TO P1, PIN 12

ADF Interface

The ADF input can interface with either an ARINC 407 XYZ input or a DC Sin/Cos, but not both, as only one ADF receiver will be interfaced at any time. The ADF interface is as follows:

ARINC 407 XYZ

A standard 11.8 VRMS, 400 Hz ARINC 407 XYZ input will be accepted for a valid ADF input.

Label	J2	Description
ADF X	3	
ADF Y	4	
ADF Z	5	
ADF REF	8	AC REFERENCE FOR XYZ

DC Sin/Cos

The Bendix/King (Honeywell) KR-87 interface has been selected as the standard for the DC Sin/Cos input. This input uses a +4.5 Vdc reference with a Sin and Cosine signal that is 3xSin (bearing) and 3xCosine (bearing) volts with respect to the reference.

Label	J2	Description
ADF DC REF	13	DC REFRENCE FOR SIN/COS
ADF SIN	14	DC SINE
ADF COS	15	DC COSINE

Radar Altimeter Interface

The Radar Altimeter input can be selected between three states, none, ARINC 552A, and ALT-55. Selecting none causes the AIU to ignore any voltage on the RADALT input and forces the EFIS to only report barometric AGL below 2500 feet. Selecting one of the other two allows the EFIS to report radar altitude below 2500 feet AGL for Class-A TAWS. The two programmed inputs are as follows:

ARINC 552A

The ARINC 552A specification is as follows:

-20 to 480 ft. V=0.02h + 0.4
480 to 2550 ft V=10 ln (h + 20) -52.1461

ALT 55

The ALT-55 specification is as follows:

-20 to 500 ft V=0.02h + 0.4
500 to 2500 ft V=0.003(h – 500) + 10.4

Label	J1	Description
RADALT IN	49	RADAR ALTIMETER DC INPUT
RADALT LOW	6	GND
RADALT FLAG	52	A+ FOR VALID

Selection programming is provided by the AIU Ground Maintenance functions (ARINC 552A is default).

Autopilot Interface

The AIU emulates an existing HSI to provide Heading and Course Datums, CDI Left/Right deflection, and Navigation Flag signal to a number of different autopilot computers. Heading and Course datums for different autopilots are selectable through the AIU Ground Maintenance functions and hardware switch settings.

The AIU can produce Heading and Course Datum signals that are either DC or AC signals. A 9 pin DIP switch and a two position slider switch are used to configure the AIU for AC or DC operation, and to select hardware gains. The switches are located at the connector end of the unit, and are accessed behind a removable cover plate.

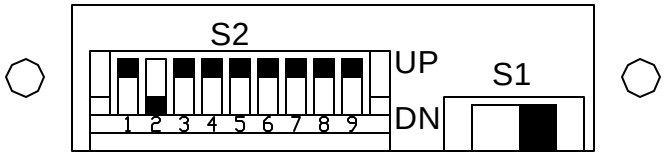


Figure 2. AIU Switch Access

NOTE: *For switch S2, "Down" is determined when the tab of the position is pointed at the numbers on the switch.*

The slider switch (S1) must be in the left position for DC operation, or right for AC operation.

The 9 pin DIP switch (S2) are assigned to the following functions, position 1 is the left-most switch:

WARNING!
Switches S1 and S2 must be set to the autopilot Course and Heading Datum operation and gain as defined above prior to application of power. Failure to set the switches may result in erroneous autopilot operations. Consult the tables below for assistance in setting the switches.

Table 7. AIU Course and Heading Datum Switches

Position	Description
1	DOWN SELECTS DC MODE OPERATION (SWITCH 2 MUST BE UP)
2	DOWN SELECTS AC MODE OPERATION (SWITCH 1 MUST BE UP)
3	HEADING DATUM GAIN (SEE FIG 3)
4	HEADING DATUM GAIN (SEE FIG 3)
5	HEADING DATUM GAIN (SEE FIG 3)
6	COURSE DATUM GAIN (SEE FIG 4)
7	COURSE DATUM GAIN (SEE FIG 4)
8	COURSE DATUM GAIN (SEE FIG 4)
9	UNUSED (UP)

3	4	5	Gain	Mode
			1X	AC or DC
			2X	AC or DC
			4.885X	AC or DC
			5.897X	AC or DC
			11.12X	AC or DC
			12.13X	DC only
			15X	DC only
			16.01X	DC only

Figure 3. Heading Datum Gain Switch Position

6	7	8	Gain	Mode
			1X	AC or DC
			2X	AC or DC
			4.885X	AC or DC
			5.897X	AC or DC
			11.12X	AC or DC
			12.13X	DC only
			15X	DC only
			16.01X	DC only

Figure 4. Course Datum Gain Switch Position

The Course and Heading Datum outputs can be configured using the AIU Ground Maintenance software to have either a linear response with angular deviation, or a Sine response with angular deviation.

There are two methods for determining the GAIN and SCALING for the AIU. The first is to measure the voltage output and angle from the original HSI and perform the following equations as described. The second is to calculate the maximum voltage at a 90° angle from the autopilot interconnect specifications and use the following equations.

NOTE: *The best method to determine the SCALING factor and GAIN is to measure the maximum Heading and Course Datum voltage from the existing HSI and calculate the scaling factor using the formulas prior to starting installation.*

If the AIU is used to replace an existing HSI, measure the Heading and Course Datums with the existing HSI installed prior to beginning modification of the aircraft or use the autopilot interface tables located later in this section.

HEADING (DEGREES)	HEADING DATUM (VOLTS AC or DC)	COURSE DATUM (VOLTS AC or DC)
30 LEFT		
20 LEFT		
10 LEFT		
CENTERED		
10 RIGHT		
20 RIGHT		
30 RIGHT		

The scaling mode (linear or sine) is determined by the measured values in the table above. A linear mode will have an equal voltage difference from one measured heading value to the next.

For DC mode operation, the following equations describe the behavior of the heading and course datum outputs:

DC Linear Scaling Mode:

$$\text{OUTPUT} = 3.33 \times \frac{\text{SCALING}}{3300} \times \text{GAIN} \times \frac{\text{ANGLE}}{90}$$

DC Sine Scaling Mode:

$$\text{OUTPUT} = 3.33 \times \frac{\text{SCALING}}{3300} \times \text{GAIN} \times \text{SIN(ANGLE)}$$

Where: SCALING is the scaling factor set up by the AIU Ground Maintenance program from 1 to 3300, GAIN is the gain value selected using the DIP switches (1X, 2X, 4.885X, 5.897X, 11.12X, 12.13X, 15X, or 16.01X) and ANGLE is the angular deviation for the heading or course datum. The maximum DC signal swing is +/- 16V. The output will saturate at the maximum DC level if a value higher than that level is commanded.

EXAMPLE 1:

The AIU will replace an existing KI-525A HSI. The HSI was measured as follows:

HEADING (DEGREES)	HEADING DATUM (VOLTS AC or DC)	COURSE DATUM (VOLTS AC or DC)
30 LEFT	16.5 VDC	6.0 VDC
20 LEFT	11.0 VDC	4.0 VDC
10 LEFT	5.5 VDC	2.0 VDC
CENTERED	0.0 VDC	0.0 VDC
10 RIGHT	5.5 VDC	2.0 VDC
20 RIGHT	11.0 VDC	4.0 VDC
30 RIGHT	16.5 VDC	6.0 VDC

The HSI outputs a linear DC Heading and Course Datum. The GAIN value for Heading Datum is determined by using the largest measured output voltage (16.5) and divide it by the constant (3.33) times the associated heading (30) divided by 90. The resultant is 14.86. Use the next greater GAIN value (15X) for the OUTPUT equation.

Use the DC Linear Scaling Mode formula for the Heading Datum:
OUTPUT = 3.33 x (SCALING/3300) x GAIN x (ANGLE (30)/90)
16.5 = 3.33 x (SCALING/3300) x 15 x 0.33
16.5 / 16.65 = SCALING / 3300
0.99 x 3300 = SCALING
3270 = SCALING

The Autopilot Scaling for Heading Datum in the AIU Maintenance program will be set to an initial value of 3270, and switches 3 thru 5 on S2 should be positioned for 15X as shown in Figure 3.

The Course Datum is calculated the same way as Heading Datum. The GAIN value for Course Datum is determined by using the largest measured output voltage (6.0) and divide it by the constant (3.33) times the associated heading (30) divided by 90. The resultant is 5.40. Use the next greater GAIN value (5.897X) for the output equation.

Use the DC Linear Scaling Mode formula for the Course Datum:
OUTPUT = 3.33 x (SCALING/3300) x GAIN x (ANGLE (30)/90)
6.0 = 3.33 x (SCALING/3300) x 5.897 x 0.33
6.0 / 6.55 = SCALING/3300
0.92 x 3300 = SCALING
3025 = SCALING

The Autopilot Scaling for Course Datum in the AIU Maintenance program will be set to an initial value of 3025, and switches 6 thru 8 on S2 should be positioned for 5.897X as shown in Figure 4.

For AC mode operation, the RMS voltage is determined by the following equations:

X1 AC Excitation Linear Scaling Mode:

$$\text{OUTPUT} = 1.94 \times \frac{\text{SCALING}}{3300} \times \text{GAIN} \times \frac{\text{ANGLE}}{90}$$

X1 AC Excitation Sine Scaling Mode:

$$\text{OUTPUT} = 1.94 \times \frac{\text{SCALING}}{3300} \times \text{GAIN} \times \text{SIN(ANGLE)}$$

X2 AC Excitation Linear Scaling Mode:

$$\text{OUTPUT} = 3.13 \times \frac{\text{SCALING}}{3300} \times \text{GAIN} \times \frac{\text{ANGLE}}{90}$$

X2 AC Excitation Sine Scaling Mode:

$$\text{OUTPUT} = 3.13 \times \frac{\text{SCALING}}{3300} \times \text{GAIN} \times \text{SIN(ANGLE)}$$

Where: SCALING is the scaling factor set up by the AIU Ground Maintenance program from 1 to 3300, GAIN is the gain value selected using the DIP switches (1X, 2X, 4.885X, and 5.897X) and ANGLE is the angular deviation for the heading or course datum. The gain times the factor (3.13 or 1.94) must be greater than the maximum output voltage.

EXAMPLE 2:

A new autopilot is being installed in the aircraft under the autopilot STC in addition to the AIU STC. The autopilot requires a Heading and Course Datum voltage of 300mV/Deg at 400 Hz. The voltage required for maximum deviation is 12VRMS at 60 degrees. The AIU can output a maximum deviation of 11.4VRMS, so the X2 transformer option must be used to increase the output voltage to meet the requirements.

To determine the GAIN value, take the maximum output voltage (12) and divide it by the product of the constant (3.13) and the angle (60/90). The resultant is 5.75. Use the next greater Gain value (5.897X) for the OUTPUT equation.

Using the X2 AC Linear Scaling Mode formula:

$$\text{Output} = 3.13 \times (\text{SCALING}/3300) \times \text{GAIN} \times \text{ANGLE}/90$$
$$12 = 3.13 \times (\text{SCALING}/3300) \times 5.897 \times 60/90$$
$$12 / 12.31 = \text{SCALING} / 3300$$
$$0.975 \times 3300 = \text{SCALING}$$
$$3218 = \text{SCALING}$$

The Autopilot Scaling for Heading and Course Datum in the AIU Maintenance program should be set to an initial value of 3218, and switches 2 thru 8 on S2 should be positioned for 5.897X as shown in Figures 3 and 4.

EXAMPLE 3:

The existing HSI in the aircraft was measured as follows at 5KHz:

HEADING (DEGREES)	HEADING DATUM (VOLTS AC or DC)	COURSE DATUM (VOLTS AC or DC)
30 LEFT	3.00 VAC	3.00 VAC
20 LEFT	1.36 VAC	1.36 VAC
10 LEFT	0.35 VAC	0.35 VAC
CENTERED	0.0 VAC	0.0 VAC
10 RIGHT	0.35 VAC	0.35 VAC
20 RIGHT	1.36 VAC	1.36 VAC
30 RIGHT	3.00 VAC	3.00 VAC

The AIU can generate these output voltages without amplification, so the X1 transformer option is used.

To determine the GAIN value, take the largest measured output voltage (3.00) and divide it by the constant (1.94) times the sine of the associated heading (30). The resultant is 3.09. Use the next greater Gain value (4.885X) for the OUTPUT equation.

Using the X1 AC Sine Scaling Mode Formula at 30 deg. ANGLE:
OUTPUT = 1.94 x (SCALING/3300) x GAIN x SIN(ANGLE)
3.00 =1.94 x (SCALING/3300) x 4.885 x 0.5
3.00 / 4.73 = SCALING / 3300
0.63 x 3300 = SCALING
2089 = SCALING

The Autopilot Scaling for Heading and Course Datum in the AIU Maintenance Program should be set to an initial value of 2089, and switches 2 thru 8 on S2 should be positioned for 4.885X as shown in Figures 3 and 4.

Use the following tables to aid in initial setup of the AIU. Flight testing after installation is required to properly align the AIU to the autopilot.

AUTOPILOT INTERFACING (HSI EMULATION)	PAGE
Chelton AP-3C (DC)	32
Bendix/King KFC-150 (DC)	33
Bendix/King KFC-225 (DC)	34
Bendix/King KFC-250 (400Hz AC)	35
Bendix/King KFC-300 (400Hz AC)	36
Bendix/King KFC-325 (400Hz AC)	37
Cessna 400/800 (400Hz AC)	38
Cessna 1000 (400Hz AC)	39
Collins APS-65 (400Hz AC)	40
Collins APC-65A (400Hz AC)	41
Collins FCS-80 (400Hz AC)	42
Collins AP-106 (400Hz AC)	43
S-Tec Magic 1500 (5KHz AC)	44
S-Tec 20/30/30ALT (DC)	45
S-Tec 55X (DC)	46
S-Tec 65 (5KHz AC)	47
Sperry SPZ-200 and SPZ-500 (400Hz AC)	48

NOTE: *The information contained in the following tables is to be used as initial settings. Ground and flight tests must be performed to fully align the EFIS to the autopilot.*

Chelton AP-3C Autopilot

SETTING	VALUE
DIP SW 1	DOWN
DIP SW 2	UP
DIP SW 3	UP
DIP SW 4	UP
DIP SW 5	DOWN
DIP SW 6	NA
DIP SW 7	NA
DIP SW 8	NA
DIP SW 9	UP
SLIDE SWITCH SW1	LEFT
AUTOPILOT SCALING – HEADING	3250
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	NA
AUTOPILOT COURSE POLARITY	NA
AUTOPILOT DATUM SCALING	LINEAR
FLIGHT DIRECTOR SCALING – HORIZONTAL	NA
FLIGHT DIRECTOR HORZ POLARITY	NA
FLIGHT DIRECTOR SCALING – VERTICAL	NA
FLIGHT DIRECTOR VERT POLARITY	NA
FLIGHT DIRECTOR VALID FLAG	NA
TRANSFORMER INPUT	NA

400mV/Deg DC Heading Datum

Bendix/King (Honeywell) KFC-150 with KI-525A

SETTING	VALUE
DIP SW 1	DOWN
DIP SW 2	UP
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	DOWN
DIP SW 6	UP
DIP SW 7	UP
DIP SW 8	DOWN
DIP SW 9	UP
SLIDE SWITCH SW1	LEFT
AUTOPILOT SCALING – HEADING	3250
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	1650
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	LINEAR
FLIGHT DIRECTOR SCALING – HORIZONTAL	75mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	74mV
FLIGHT DIRECTOR VERT POLARITY	+ DOWN
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	NA

550mV/Deg DC Heading Datum
200mV/Deg DC Course Datum

Bendix/King (Honeywell) KFC-225 with KI-525A

SETTING	VALUE
DIP SW 1	DOWN
DIP SW 2	UP
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	DOWN
DIP SW 6	UP
DIP SW 7	UP
DIP SW 8	DOWN
DIP SW 9	UP
SLIDE SWITCH SW1	LEFT
AUTOPILOT SCALING – HEADING	3250
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	1650
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	LINEAR
FLIGHT DIRECTOR SCALING – HORIZONTAL	200mV
FLIGHT DIRECTOR HORZ POLARITY	+ RIGHT
FLIGHT DIRECTOR SCALING – VERTICAL	200mV
FLIGHT DIRECTOR VERT POLARITY	+ DOWN
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	NA

550mV/Deg DC Heading Datum
200mV/Deg DC Course Datum

Bendix/King (Honeywell) KFC-250 with EFIS

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	DOWN
DIP SW 4	DOWN
DIP SW 5	UP
DIP SW 6	DOWN
DIP SW 7	DOWN
DIP SW 8	UP
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	3300
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	3300
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	SINE
FLIGHT DIRECTOR SCALING – HORIZONTAL	300mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	300mV
FLIGHT DIRECTOR VERT POLARITY	+ UP
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

393mV/Deg AC, 400Hz Heading Datum
393mV/Deg AC, 400Hz Course Datum

Bendix/King (Honeywell) KFC-300

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	DOWN
DIP SW 4	DOWN
DIP SW 5	UP
DIP SW 6	DOWN
DIP SW 7	DOWN
DIP SW 8	UP
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	3300
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	3300
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	SINE
FLIGHT DIRECTOR SCALING – HORIZONTAL	400mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	200mV
FLIGHT DIRECTOR VERT POLARITY	+ UP
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

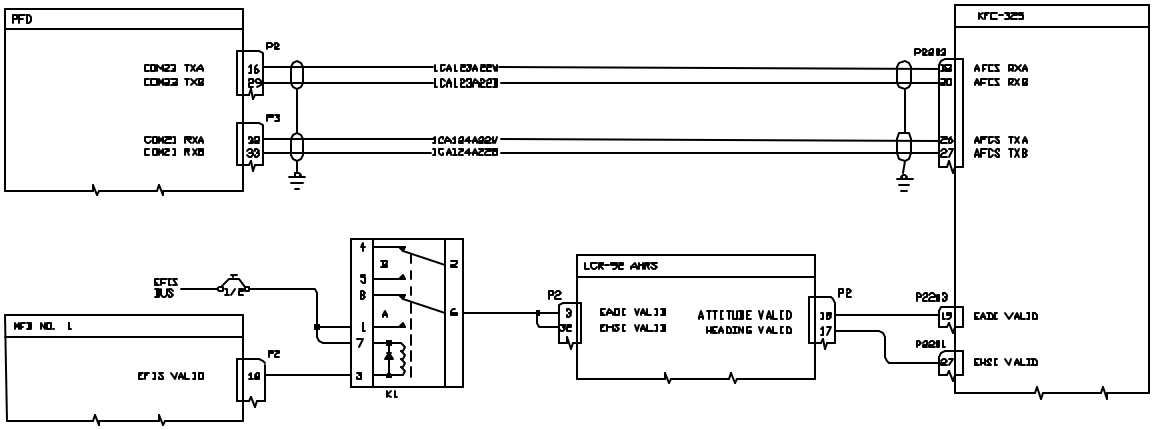
393mV/Deg AC, 400Hz Heading Datum
393mV/Deg AC, 400Hz Course Datum

Bendix/King (Honeywell) KFC-325 with EFIS

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	UP
DIP SW 6	UP
DIP SW 7	DOWN
DIP SW 8	UP
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	3300
AUTOPILOT HEADING POLARITY	+ LEFT
AUTOPILOT SCALING – COURSE	3300
AUTOPILOT COURSE POLARITY	+ LEFT
AUTOPILOT DATUM SCALING	SINE
FLIGHT DIRECTOR SCALING – HORIZONTAL	475mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	300mV
FLIGHT DIRECTOR VERT POLARITY	+ UP
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

393mV/Deg AC, 400Hz Heading Datum
393mV/Deg AC, 400Hz Course Datum

NOTE: *This interface was performed with a KAP 220 -15 autopilot and Litef LCR-92 AHRS on a Pilatus PC-12. To emulate the original Bendix/King EFIS-40/50 installation, the following wiring was added:*



Cessna 400/800 Autopilot with IG-832A HSI

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	UP
DIP SW 6	UP
DIP SW 7	DOWN
DIP SW 8	UP
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	2370
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	2370
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	SINE
FLIGHT DIRECTOR SCALING – HORIZONTAL	12mV
FLIGHT DIRECTOR HORZ POLARITY	+ RIGHT
FLIGHT DIRECTOR SCALING – VERTICAL	20mV
FLIGHT DIRECTOR VERT POLARITY	+ UP
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

350mV/Deg AC, 400Hz Heading Datum
350mV/Deg AC, 400Hz Course Datum

Cessna 1000 Autopilot

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	UP
DIP SW 6	UP
DIP SW 7	DOWN
DIP SW 8	UP
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	2600
AUTOPILOT HEADING POLARITY	+ LEFT
AUTOPILOT SCALING – COURSE	2600
AUTOPILOT COURSE POLARITY	+ LEFT
AUTOPILOT DATUM SCALING	SINE
FLIGHT DIRECTOR SCALING – HORIZONTAL	12mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	12mV
FLIGHT DIRECTOR VERT POLARITY	+ UP
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

378mV/Deg AC, 400Hz Heading Datum
378mV/Deg AC, 400Hz Course Datum

Collins APS-65

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	UP
DIP SW 4	UP
DIP SW 5	DOWN
DIP SW 6	UP
DIP SW 7	UP
DIP SW 8	DOWN
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	3000
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	3000
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	LINEAR
FLIGHT DIRECTOR SCALING – HORIZONTAL	150mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	50mV
FLIGHT DIRECTOR VERT POLARITY	+ DOWN
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

300mV/deg AC, 400Hz Heading Datum
300mV/deg AC, 400Hz Course Datum

Collins APC-65A

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	UP
DIP SW 4	UP
DIP SW 5	DOWN
DIP SW 6	UP
DIP SW 7	UP
DIP SW 8	DOWN
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	3000
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	3000
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	LINEAR
FLIGHT DIRECTOR SCALING – HORIZONTAL	150mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	50mV
FLIGHT DIRECTOR VERT POLARITY	+ DOWN
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

300mV/deg AC, 400Hz Heading Datum
300mV/deg AC, 400Hz Course Datum

Collins FCS-80

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	UP
DIP SW 6	UP
DIP SW 7	DOWN
DIP SW 8	UP
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	2700
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	3000
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	SINE
FLIGHT DIRECTOR SCALING – HORIZONTAL	150mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	150mV
FLIGHT DIRECTOR VERT POLARITY	+ DOWN
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

200mV/deg AC, 400Hz Heading Datum
200mV/deg AC, 400Hz Course Datum

Collins AP-106

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	UP
DIP SW 6	UP
DIP SW 7	DOWN
DIP SW 8	UP
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	2500
AUTOPILOT HEADING POLARITY	+ LEFT
AUTOPILOT SCALING – COURSE	2100
AUTOPILOT COURSE POLARITY	+ LEFT
AUTOPILOT DATUM SCALING	SINE
FLIGHT DIRECTOR SCALING – HORIZONTAL	100mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	100mV
FLIGHT DIRECTOR VERT POLARITY	+ UP
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

200mV/deg AC, 400Hz Heading Datum
200mV/deg AC, 400Hz Course Datum

NOTE: *If connected to an FD-112 Flight Director, cap and stow the following pins at the Flight Director:*

J2 pin X Heading Error X
J2 pin B Heading Error Y
J2 pin D Course Datum X
J2 pin Y Course Datum Y

S-Tec Magic 1500 Autopilot

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	UP
DIP SW 6	UP
DIP SW 7	DOWN
DIP SW 8	UP
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	2200
AUTOPILOT HEADING POLARITY	+ LEFT
AUTOPILOT SCALING – COURSE	2200
AUTOPILOT COURSE POLARITY	+ LEFT
AUTOPILOT DATUM SCALING	SINE
FLIGHT DIRECTOR SCALING – HORIZONTAL	35mV
FLIGHT DIRECTOR HORZ POLARITY	+LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	70mV
FLIGHT DIRECTOR VERT POLARITY	+DOWN
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X1

200mV/Deg AC, 5 KHz Heading Datum
200mV/Deg AC, 5 KHz Course Datum

S-Tec 20/30/30ALT

SETTING	VALUE
DIP SW 1	DOWN
DIP SW 2	UP
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	DOWN
DIP SW 6	UP
DIP SW 7	UP
DIP SW 8	DOWN
DIP SW 9	UP
SLIDE SWITCH SW1	LEFT
AUTOPILOT SCALING – HEADING	2500
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	2500
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	LINEAR
FLIGHT DIRECTOR SCALING – HORIZONTAL	N/A
FLIGHT DIRECTOR HORZ POLARITY	N/A
FLIGHT DIRECTOR SCALING – VERTICAL	N/A
FLIGHT DIRECTOR VERT POLARITY	N/A
FLIGHT DIRECTOR VALID FLAG	NA
TRANSFORMER INPUT	NA

550mV/Deg DC Heading Datum

S-Tec 55X Autopilot with KI-525A

SETTING	VALUE
DIP SW 1	DOWN
DIP SW 2	UP
DIP SW 3	UP
DIP SW 4	DOWN
DIP SW 5	DOWN
DIP SW 6	UP
DIP SW 7	UP
DIP SW 8	DOWN
DIP SW 9	UP
SLIDE SWITCH SW1	LEFT
AUTOPILOT SCALING – HEADING	3300
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	1650
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	LINEAR
FLIGHT DIRECTOR SCALING – HORIZONTAL	40mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	80mV
FLIGHT DIRECTOR VERT POLARITY	+ DOWN
FLIGHT DIRECTOR VALID FLAG	NA
TRANSFORMER INPUT	NA

550mV/Deg DC Heading Datum
200mV/Deg DC Course Datum

S-Tec 65 Autopilot

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	DOWN
DIP SW 4	UP
DIP SW 5	DOWN
DIP SW 6	UP
DIP SW 7	UP
DIP SW 8	UP
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	1000
AUTOPILOT HEADING POLARITY	+ RIGHT
AUTOPILOT SCALING – COURSE	1000
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	LINEAR
FLIGHT DIRECTOR SCALING – HORIZONTAL	200mV
FLIGHT DIRECTOR HORZ POLARITY	+ RIGHT
FLIGHT DIRECTOR SCALING – VERTICAL	200mV
FLIGHT DIRECTOR VERT POLARITY	+ UP
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X2

100mV/Deg AC, 5KHz Heading Datum
100mV/Deg AC, 5KHz Course Datum

Sperry SPZ-200 and SPZ-500

SETTING	VALUE
DIP SW 1	UP
DIP SW 2	DOWN
DIP SW 3	UP
DIP SW 4	UP
DIP SW 5	DOWN
DIP SW 6	UP
DIP SW 7	UP
DIP SW 8	DOWN
DIP SW 9	UP
SLIDE SWITCH SW1	RIGHT
AUTOPILOT SCALING – HEADING	2600
AUTOPILOT HEADING POLARITY	+ LEFT
AUTOPILOT SCALING – COURSE	2600
AUTOPILOT COURSE POLARITY	+ RIGHT
AUTOPILOT DATUM SCALING	LINEAR
FLIGHT DIRECTOR SCALING – HORIZONTAL	7mV
FLIGHT DIRECTOR HORZ POLARITY	+ LEFT
FLIGHT DIRECTOR SCALING – VERTICAL	9mV
FLIGHT DIRECTOR VERT POLARITY	+ UP
FLIGHT DIRECTOR VALID FLAG	HIGH
TRANSFORMER INPUT	X1

200mV/deg AC, 400Hz Heading Datum
200mV/deg AC, 400Hz Course Datum

NOTE: *Nav and Glideslope flags must be routed through a Bendix/King KDA-688 or equivalent Super Flag Converter for proper autopilot operation.*

Autopilot CRS and HDG

Adjustment of the Course and Heading output are performed from the AIU Maintenance program and hardware switches.

Label	J2	Description
AC EXCITATION	9	AC DATUM REFERENCE
DC REF	10	DC DATUM REFERENCE
HDG	11	HEADING DATUM (AC OR DC)
CRS	12	COURSE DATUM (AC OR DC)

AC Heading Isolation

The Heading isolation is a center-tap transformer that isolates the Heading Datum output from P2 for autopilots that require 400Hz or 5 KHz AC HDG.

Label	P3	Description
HDG DATUM 1X	1	X1 HDG INPUT(FROM P2, PIN 11)
HDG DATUM 2X	2	X2 HDG INPUT (FROM P2, PIN 11)
HDG DATUM LOW	3	HDG INPUT LOW
HDG OUT HI	4	HDG OUTPUT HIGH (TO AUTOPILOT)
HDG OUT CT	5	HDG OUTPUT CENTER TAP
HDG OUT LO	6	HDG OUTPUT LOW (TO AUTOPILOT)

AC Course Isolation

The Course isolation is a center-tap transformer that isolates the Course Datum output from P2 for autopilots that require 400Hz or 5 KHz AC CRS.

Label	P3	Description
CRS DATUM 1X	9	X1 CRS INPUT (FROM P2, PIN 12)
CRS DATUM 2X	10	X2 CRS INPUT (FROM P2, PIN 12)
CRS DATUM LOW	11	CRS INPUT LOW
CRS OUT HI	12	CRS OUTPUT HIGH (TO AUTOPILOT)
CRS OUT CT	13	CRS OUTPUT CENTER TAP
CRS OUT LO	14	CRS OUTPUT LOW (TO AUTOPILOT)

AC Excitation Scaling

When connecting to an autopilot that requires 400Hz Course and Heading Datum inputs, the AIU must scale the AC reference input for proper operation.

Label	P3	Description
26VAC 400HZ IN	16	AC REFERENCE INPUT
AC EXCITATION	17	SCALED AC REFERENCE TO P2, PIN 9

Navigation Output

The AIU provides a standard ±150mVDC for full scale deflection from the VOR, Localizer, or GPS output depending on the HSI source selection.

Label	J1	Description
+LEFT	40	AUTOPILOT +LEFT COMMAND
+RIGHT	39	AUTOPILOT +RIGHT COMMAND
+FLAG	47	AUTOPILOT +FLAG
-FLAG	48	AUTOPILOT -FLAG

Flight Director Interface

For those installations that require a flight director input displayed on the EFIS, the AIU can be programmed to accept the most flight director inputs. Selection of the flight director is accomplished from the AIU Ground Maintenance functions.

Flight Director Valid is connected only if the flight director computer outputs a valid flag.

The AIU Ground Maintenance functions allow the flight director scaling in mV/deg, the flight director polarity, and the flight director flag polarity (active high or low) to be configured.

FLIGHT DIRECTOR SETUP

The Flight Director Horizontal and Vertical scaling in the AIU Maintenance program must be set by commanding a full scale deflection from the autopilot.

STEP	DESCRIPTION
1	Level the aircraft for Autopilot testing
2	Apply power to autopilot and EFIS system
3	Allow autopilot and EFIS attitude sources time to stabilize
4	Select Flight Director mode on the autopilot and EFIS
5	Ensure the autopilot gyro is level in the vertical and horizontal axis to ±0.5°.
	HORIZONTAL COMMAND BAR
6	Determine if the EFIS horizontal command bar is centered. Change the Flight Director Null – Horizontal in the AIU Maintenance program until the horizontal command bar is centered (Right = +).
7	Command a full scale deflection left by either rotating the autopilot gyro at least 40° left or selecting a heading deviation of at least 40° left of the direction of flight.

STEP	DESCRIPTION
	Ensure that the autopilot senses a full scale left deviation.
6	Monitor the EFIS horizontal command bar and change the Flight Director Scaling – Horizontal in the AIU Maintenance program until full scale deflection is achieved. Note the result.
7	Command a full scale right deflection by either rotating the autopilot gyro at least 60° right or selecting a heading deviation of at least 60° right of the direction of flight. Ensure the autopilot senses a full scale right deviation.
8	Monitor the EFIS horizontal command bar and change the Flight Director Scaling – Horizontal in the AIU Maintenance program until full scale deflection is achieved. Note the result.
9	If the values from steps 6 and 8 are different, add the values together and divide by 2. Place this new number in the Flight Director Scaling – Horizontal box in the AIU Maintenance program.
10	Center the horizontal deflection and verify the horizontal command bar on the EFIS is centered. Adjust the Flight Director Null – Horizontal in the AIU Maintenance program until the EFIS command bar is centered.
11	Repeat steps 7 thru 10 until the EFIS horizontal command bar is at full scale deflection left and right, and is centered when the autopilot is at null.
	VERTICAL COMMAND BAR
12	Determine if the EFIS vertical command bar is level. Change the Flight Director Null – Vertical in the AIU Maintenance program until the vertical command bar is level (Up = +).
13	Command a full scale deflection up by rotating the autopilot gyro at least 20° up. Ensure the autopilot senses a full scale up deviation.
14	Monitor the EFIS vertical command bar and change the Flight Director Scaling – Vertical until full scale deflection is achieved. Note the result.
15	Command a full scale deflection down by rotating the autopilot gyro 40° down. Ensure the autopilot senses a full scale down deviation.
16	Monitor the EFIS vertical command bar and change the Flight Director Scaling – Vertical until full scale deflection is achieved. Note the result.
17	If the values from steps 14 and 16 are different, add the values together and divide by 2. Place this new number in the Flight Director Scaling – Vertical box in the AIU

STEP	DESCRIPTION
	Maintenance program.
19	Level the autopilot gyro and determine if the EFIS vertical command bar is level. Adjust the Flight Director Null – Vertical in the AIU Maintenance program until the vertical command bar is level.
20	Repeat steps 13 thru 19 until the EFIS vertical command bar is at full scale deflection up and down and is level when the autopilot gyro is level.
21	Secure power to the EFIS and autopilot.

The preceding steps are for initial settings of the Flight Director. A flight test must be performed to complete the installation as described in Chapter 6.

Label	J1	Description
FD +UP	21	FLIGHT DIRECTOR +UP
FD +DN	41	FLIGHT DIRECTOR +DN
FD +LT	42	FLIGHT DIRECTOR +LEFT
FD +RT	43	FLIGHT DIRECTOR +RIGHT
FD VALID	18	FLIGHT DIRECTOR VALID

Discrete Switch Interface

The discrete switch inputs to the AIU are defined as follows:

Landing Flaps

The landing flaps discrete is used in Class-A TAWS which require flap inputs to determine if the flaps are in the landing configuration. A ground on this input signals that the flaps are in the landing configuration.

Label	J1	Description
FLAP	15	GND FOR LANDING POSITION

Low Torque

The low torque discrete is used in Class-A TAWS for helicopters to determine if the rotor torque is in a low condition for landing. A ground on this input signals that the rotor torque is low.

Label	J1	Description
LOW TORQUE	17	GND FOR LOW TORQUE

There are additional input and output discrete pins that are not defined at this time.

Label	J1	Description
DISCRETE IN 7	34	RESERVED INPUT
DISCRETE IN 8	35	RESERVED INPUT

Annunciated Switch Interface

The AIU Installation Kit contains a momentary SPST push button switch and placard for GLIDESLOPE CANCEL operation. The installer has the option of substituting this switch with an annunciated switch manufactured by Eaton or Korry if desired. Consult CFS *Field Service Notice: EFIS-II Installation* for manufactures part numbers of switches and associated hardware. The switch is wired to the EFIS system using drawings 702-045250, and 702-045251 as required.

NOTE: *Glideslope Cancel switch is only required for Class-A TAWS.*

Label	J1	Description
GLIDESLOPE CANCEL	16	GND TO INHIBIT

Program the EFIS

The EFIS must be programmed to use the AIU and associated signals. Programming the EFIS is described in the EFIS Installation Guide (Doc. 150-045264 Chapter 5).

Using the IDU Limits program, select *VOR Option* as "Installed" and select the *Analog Interface Unit* as "AIU-1 Installed." Verify that the other limits and boxes are correct for the aircraft that you are updating, then save the limits.txt file to a SmartMedia card for downloading to the EFIS. Perform the download function as described in the EFIS Installation Guide, Chapter 5.

WARNING!
EFIS system software must be Version 4.1A or later.

Task 4. Cable Termination

Cable connectors P1, J2, and P3 use an EMI/RFI backshell assembly to protect the signals from degradation due to external interference. To maintain this protection, the installer must properly terminate all shielded wire (especially data lines) to the backshell as described below.

1. Cut the cable to the desired length and slide the grommet into the cable.

2. Strip cable jacket from end of conductors. Take care not to cut foil or braid. Refer to Table 8 for the cable jacket strip length.

3. If using braided cable, fold braid back over cable without splitting or slicing braid. If using foil cable, cut foil to jacket and remove foil. If using cable with foil and braid, cut foil to jacket and remove foil after folding braid back over jacket.

4. Trim excess braid or drain wire to approximately 0.600 inches from end of cable jacket.

5. If using cable with braid, slide grommet under braid to end of cable jacket. If using cable with grain wire, slide grommet to end of cable jacket and fold drain wire over grommet.

6. Terminate conductors with contacts and insert contacts into rear of connector.

7. Position one half of cable clamp on cable and connector. Ensure that flange of connector is behind flange gripper of clamp and the grommet edge is positioned against inner strain-relief bar of cable clamp (Figure 5).

8. Position other half of cable clamp on top of cable and secure with attaching hardware.

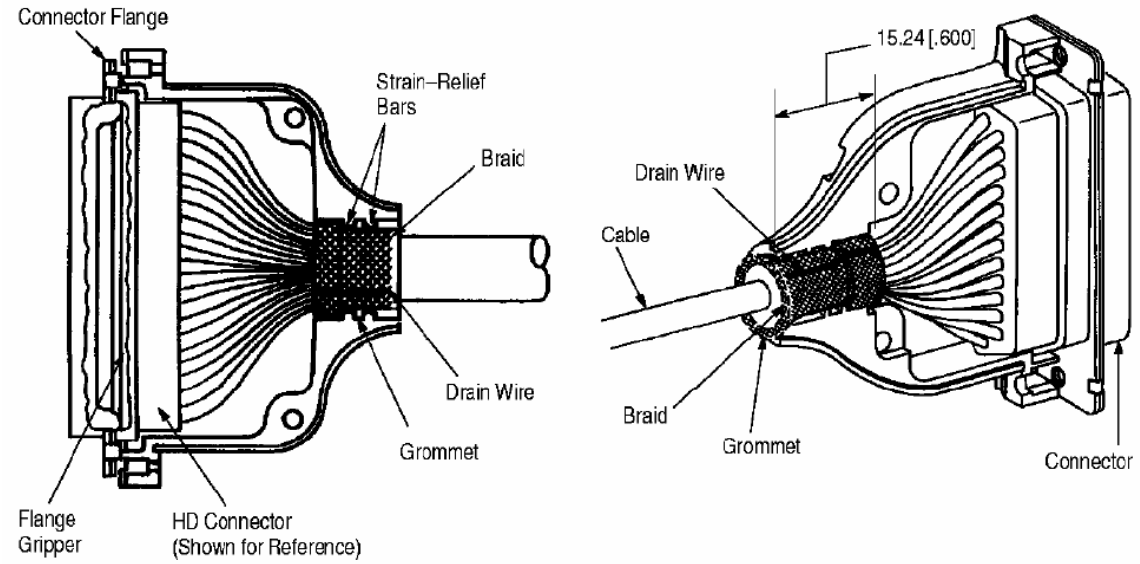


Figure 5. AIU Backshell Termination

Table 8. Cable Strip Length

POSITION	STRIP LENGTH
9 (SIZE 1)	1.00-1.50 INCHES
25 (SIZE 3)	1.30-1.60 INCHES
37 (SIZE 4)	1.40-1.70 INCHES

Figures and data for this task courtesy of Amp-Tyco/ Electronics

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Chapter 3

System Drawings

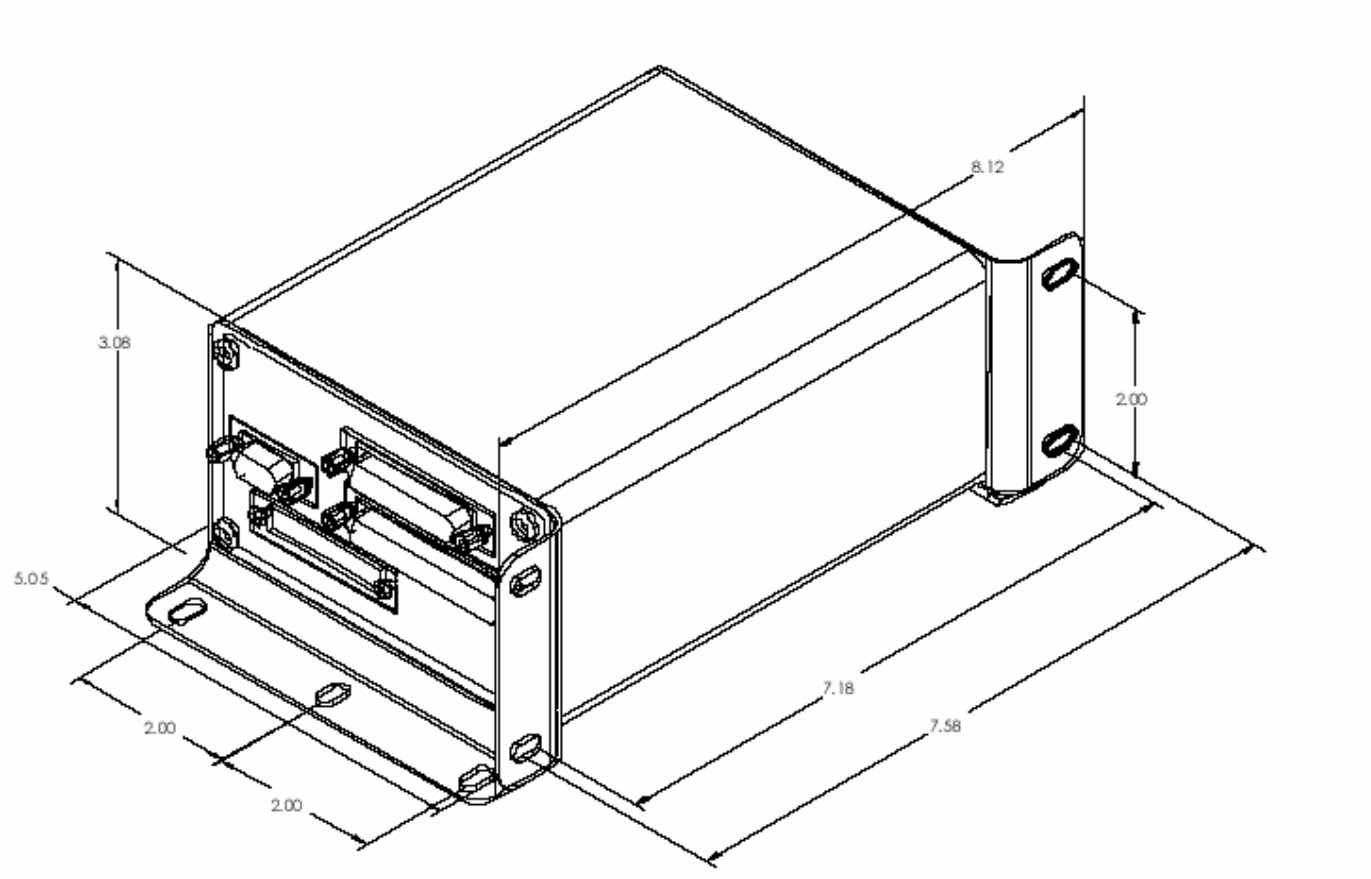
This section contains the mechanical and electrical drawings for the AIU. Additional drawings can be found in the appropriate vendor Installation Manuals.

Drawings:

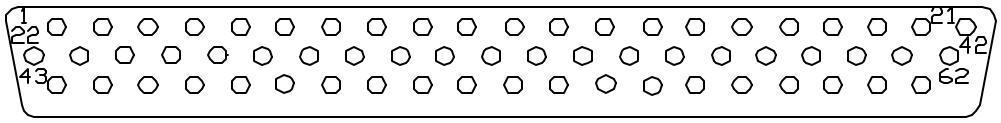
3.1 AIU Mechanical Drawing
3.2 AIU P1 Connector
3.3 AIU P2 Connector
3.4 AIU J3 Connector
3.5 AIU Wiring Diagrams

NOTE: *All connectors are shown viewed from the back.*

3.1 AIU Mechanical Drawings

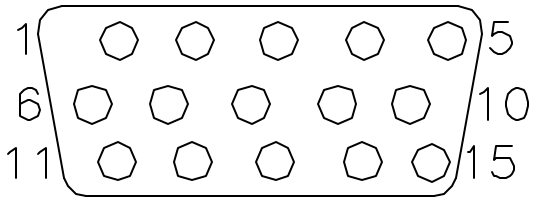


3.2 AIU P1 Connector



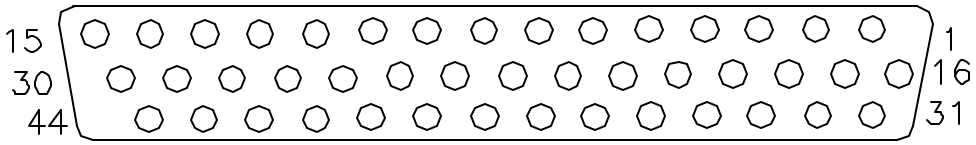
PIN	DISCRIPTION	PIN	DISCREPTION
1	COM 6 (429) RXA	32	COM 4 (232) TX
2	COM 6 (429) RXB	33	GROUND
3	GROUND	34	DISCRETE IN 7
4	COM 5 (429) RXA	35	DISCRETE IN 8
5	COM 5 (429) RXB	36	NAV 1 COMPOSITE LOW
6	GROUND	37	NAV 1 COMPOSITE HIGH
7	COM 5 (429) TXA	38	NAV 2 COMPOSITE HIGH
8	COM 5 (429) TXB	39	AUTOPILOT COMMAND +RIGHT
9	GROUND	40	AUTOPILOT COMMAND +LEFT
10	MARKER BEACON BLUE IN	41	FLIGHT DIRECTOR +DOWN
11	MARKER BEACON WHITE IN	42	FLIGHT DIRECTOR +LEFT
12	MARKER BEACON YELLOW IN	43	FLIGHT DIRECTOR +RIGHT
13	NAV 1 ILS ENERGIZE IN	44	COM 1 (232) GND
14	NAV 2 ILS ENERGIZE IN	45	GLIDESLOPE SELECT A/B
15	LANDING FLAP IN (TAWS CLASS A)	46	GROUND
16	G/S CANCEL (TAWS CLASS A)	47	AUTOPILOT NAV FLAG +
17	LOW TORQUE (HELICOPTER TAWS CLASS A)	48	AUTOPILOT NAV FLAG -
18	FLIGHT DIRECTOR VALID	49	RADAR ALTIMETER HIGH
19	NAV 2 COMPOSITE LOW	50	GROUND
20	GROUND	51	GROUND
21	FLIGHT DIRECTOR +UP	52	RADAR ALTIMETER FLAG IN
22	COM 1 (232) RX	53	GROUND
23	COM 1 (232) TX	54	NAV 1 GLIDESLOPE +UP
24	COM 2 (232) GND	55	NAV 1 GLIDESLOPE +DOWN
25	COM 2 (232) RX	56	NAV 2 GLIDESLOPE +UP
26	COM 2 (232) TX	57	NAV 2 GLIDESLOPE +DOWN
27	COM 3 (232) GND	58	NAV 1 GLIDESLOPE +FLAG
28	COM 3 (232) RX	59	NAV 1 GLIDELSOPE –FLAG
29	COM 3 (232) TX	60	NAV 2 GLIDELSOPE +FLAG
30	COM 4 (232) GND	61	NAV 2 GLIDESLOPE –FLAG
31	COM 4 (232) RX	62	GROUND

3.3 AIU P2 Connector



PIN	DISCRIPTION	PIN	DISCRIPTION
1	V-IN	9	AUTOPILOT HDG/CRS DATUM REF
2	GROUND	10	AUTOPILOT DC REFERENCE
3	ARINC 407 ADF X	11	AUTOPILOT HDG DATUM
4	ARINC 407 ADF Y	12	AUTOPILOT CRS DATUM
5	ARINC 407 ADF Z	13	ADF DC REF (KR-87 4.5VDC)
6	V-IN	14	ADF DC SIN (KR-87 SIN)
7	GROUND	15	ADF DC COS (KR-87 COS)
8	ARINC 407 ADF 26VAC REF		

3.4 AIU J3 Connector

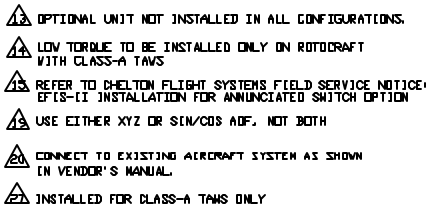


PIN	DISCRIPTION	PIN	DISCREPTION
1	HEADING DATUM IN X1	23	GLIDESLOPE 1 +UP IN
2	HEADING DATUM IN X2	24	GLIDESLOPE 1 +DN IN
3	HEADING DATUM IN LOW	25	GLIDESLOPE 2 +UP IN
4	HEADING DATUM OUT HIGH	26	GLIDESLOP E 2 +DN IN
5	HEADING DATUM OUT CENTER	27	MARKER BEACON EXCITATION
6	HEADING DATUM OUT LOW	28	MARKER BEACON PULLUP 1
7	GROUND	29	MARKER BEACON EXCITAITON
8	GROUND	30	GLIDESLOPE +FLAG OUT
9	COURSE DATUM IN X1	31	GLIDESLOPE –FLAG OUT
10	COURSE DATUM IN X2	32	GLIDESLOPE 1 +FLAG IN
11	COURSE DATUM IN LOW	33	GLIDESLOPE 1 –FLAG IN
12	COURSE DATUM OUT HIGH	34	GLIDESLOPE 2 +FLAG IN
13	COURSE DATUM OUT CENTER	35	GLIDESLOPE 2 –FLAG IN
14	COURSE DATUM OUT LOW	36	ILS ENERGIZE OUT
15	GROUND	37	SPARE
16	26VAC 400HZ IN	38	ILS ENERGIZE 1 IN
17	AUTOPILOT EXCITATION OUT	39	SPARE
18	14VDC IN	40	ILS ENERGIZE 2 IN
19	28VDC IN	41	SPARE
20	GLIDESLOPE SELECT A/B	42	MARKER BEACON EXCITATION
21	GLIDESLOPE +UP OUT	43	MARKER BEACON PULLUP 3
22	GLIDESLOPE +DN OUT	44	MARKER BEACON PULLUP 2

3.5 AIU Wiring Diagrams

Refer to Chelton drawing 702-045250 and 702-045251 for power and EFIS interfacing.

NOTES:

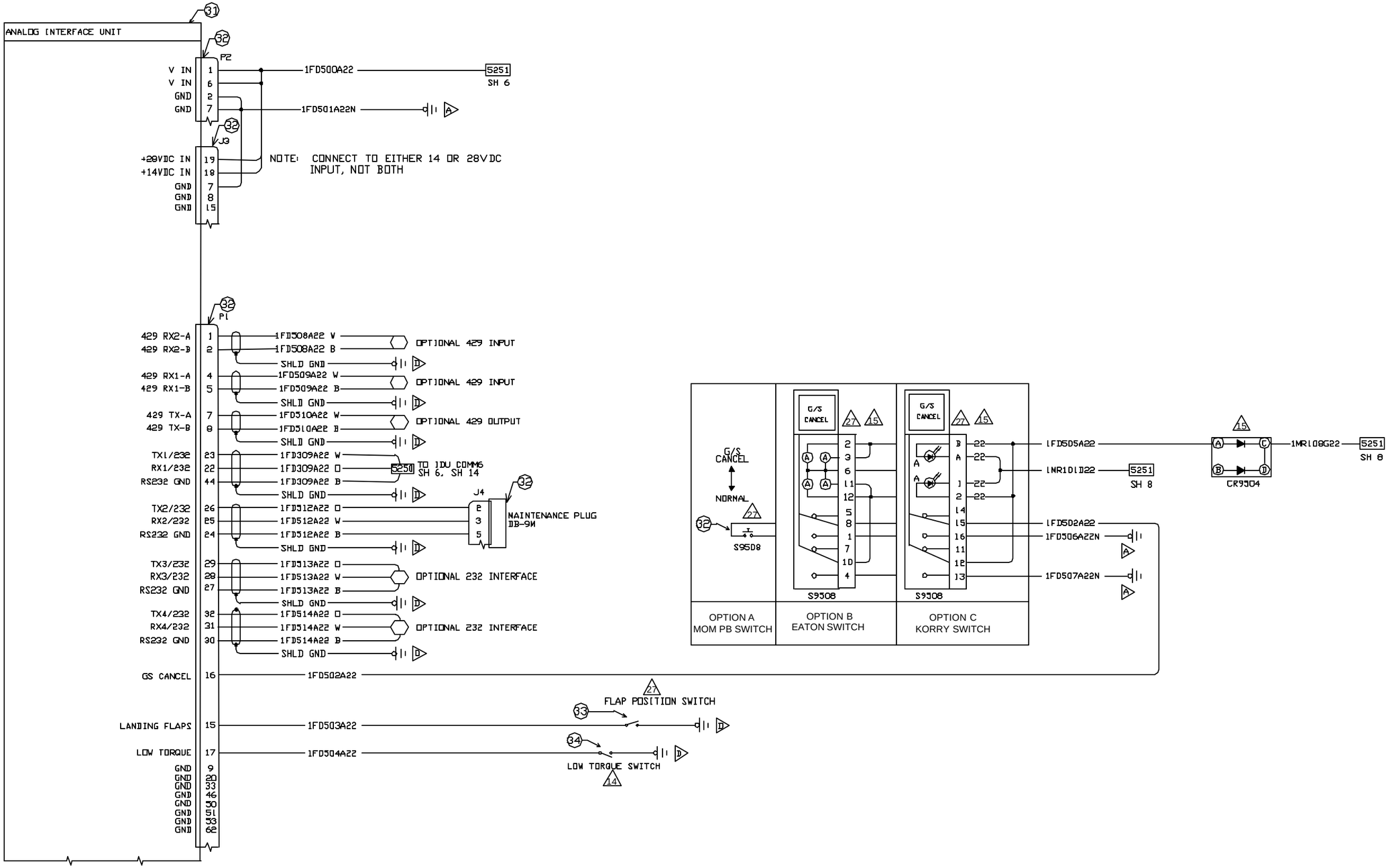


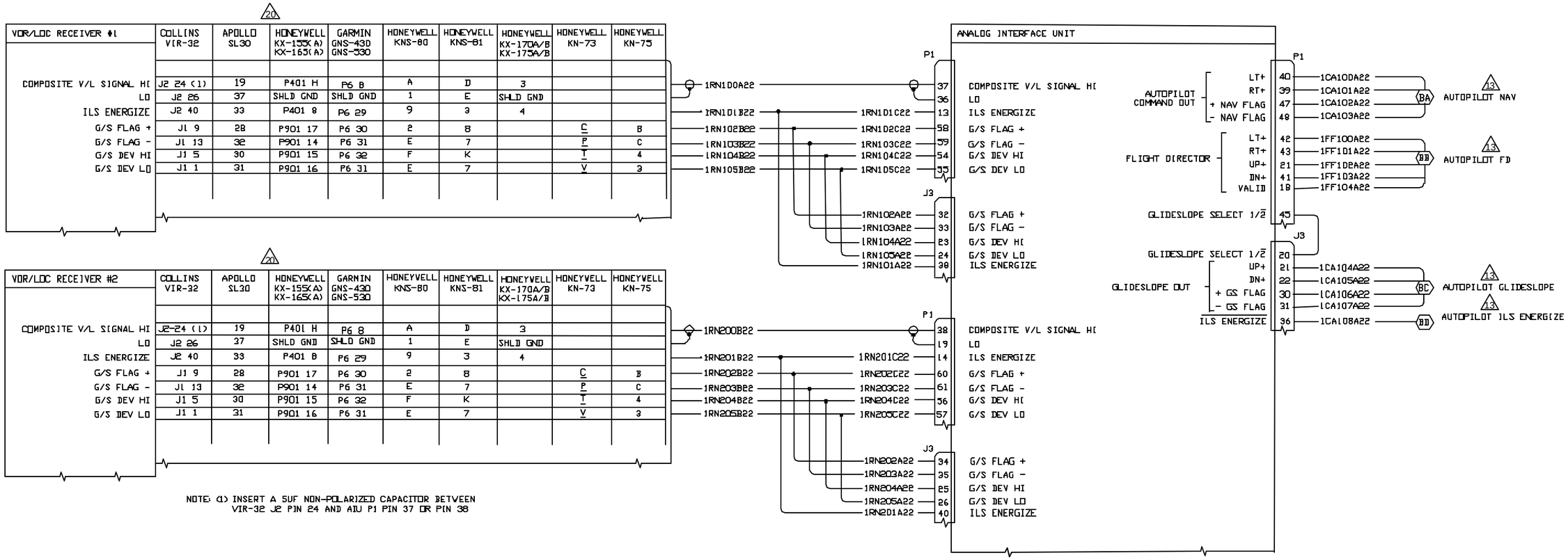
CONFIG	CLASS OF TAWS
1D1	AIRCRAFT, CLASS C
1D2	AIRCRAFT, CLASS B
1D3	AIRCRAFT, CLASS A
1D4	AIRCRAFT, CLASS A W/FLAP
1D5	HELICOPTER, CLASS C
1D6	HELICOPTER, CLASS B
1D7	HELICOPTER, CLASS A

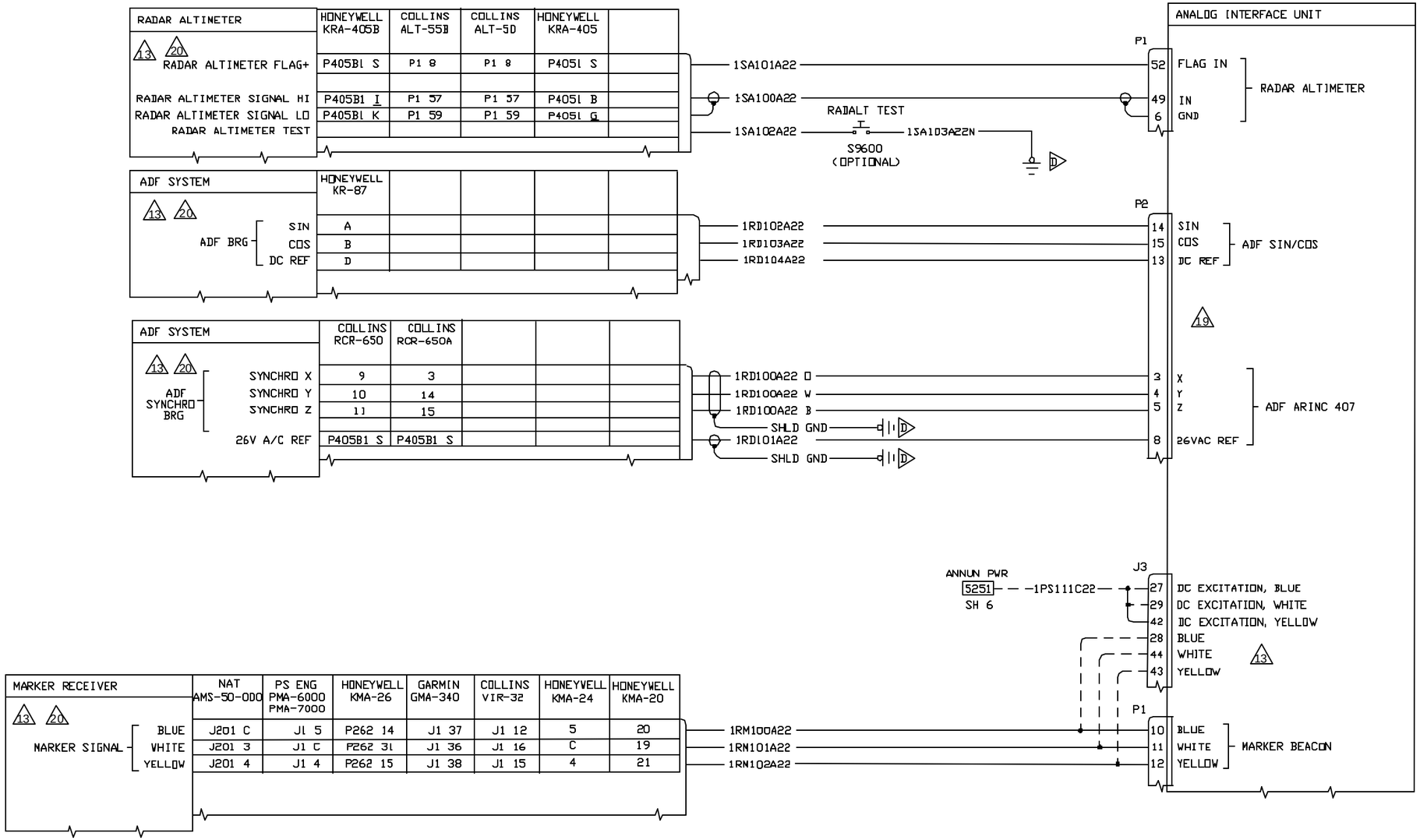
T7	T6	T5	T4	T3	T2	T1	ITEM	PART NO.	NOMENCLATURE	SPEC/VENDOR
-	-	-	1	-	-	-	24		FLAP POSITION SENSOR	
1	-	-	-	-	-	-	23		LOW TORQUE SENSOR	
1	-	-	1	1	-	-	22	455-0050	INSTALL KIT, AIU	CHELTON
1	-	-	1	1	-	-	21	453-7000	AIU-1	CHELTON

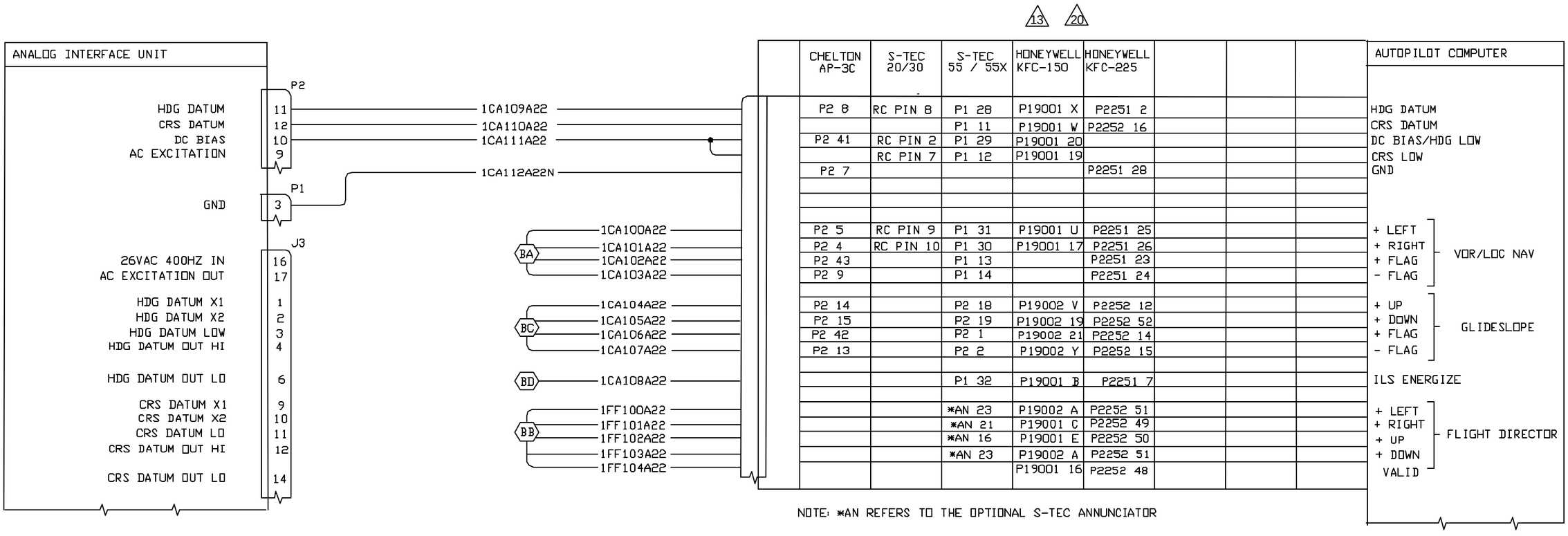
CAUTION

Refer to navigation and autopilot manufacturers Installation Manuals for proper pinout and setup of equipment in the following drawings. Interface drawings to analog equipment are for information only and may not be current.


ANALOG INTERFACE UNIT
P2
V IN 1
V IN 6
GND 2
GND 7
1FD500A22
5251 SH 6
1FD501A22N
J3
+28VDC IN 19
+14VDC IN 18
GND 7
GND 8
GND 15
NOTE: CONNECT TO EITHER 14 OR 28VDC INPUT, NOT BOTH
P1
429 RX2-A 1
429 RX2-B 2
1FD508A22 W
1FD508A22 B
SHLD GND
OPTIONAL 429 INPUT
429 RX1-A 4
429 RX1-B 5
1FD509A22 W
1FD509A22 B
SHLD GND
OPTIONAL 429 INPUT
429 TX-A 7
429 TX-B 8
1FD510A22 W
1FD510A22 B
SHLD GND
OPTIONAL 429 OUTPUT
TX1/232 23
RX1/232 22
RS232 GND 44
1FD309A22 W
1FD309A22 O
1FD309A22 B
SHLD GND
5250 TO IDU COMM6 SH 6, SH 14
J4
TX2/232 26
RX2/232 25
RS232 GND 24
1FD512A22 O
1FD512A22 W
1FD512A22 B
SHLD GND
NAINTENANCE PLUG DB-9M
TX3/232 29
RX3/232 28
RS232 GND 27
1FD513A22 O
1FD513A22 W
1FD513A22 B
SHLD GND
OPTIONAL 232 INTERFACE
TX4/232 32
RX4/232 31
RS232 GND 30
1FD514A22 O
1FD514A22 W
1FD514A22 B
SHLD GND
OPTIONAL 232 INTERFACE
GS CANCEL 16
1FD502A22
LANDING FLAPS 15
1FD503A22
FLAP POSITION SWITCH
LOW TORQUE 17
1FD504A22
LOW TORQUE SWITCH
GND 9
GND 20
GND 33
GND 46
GND 50
GND 51
GND 53
GND 62
G/S CANCEL
NORMAL
S9508
S9508
S9508
OPTION A MOM PB SWITCH
OPTION B EATON SWITCH
OPTION C KORRY SWITCH
1FD505A22
1MR108G22
5251 SH 8
1MR101D22
5251 SH 8
CR9504
1FD505A22
1FD506A22N
1FD507A22N

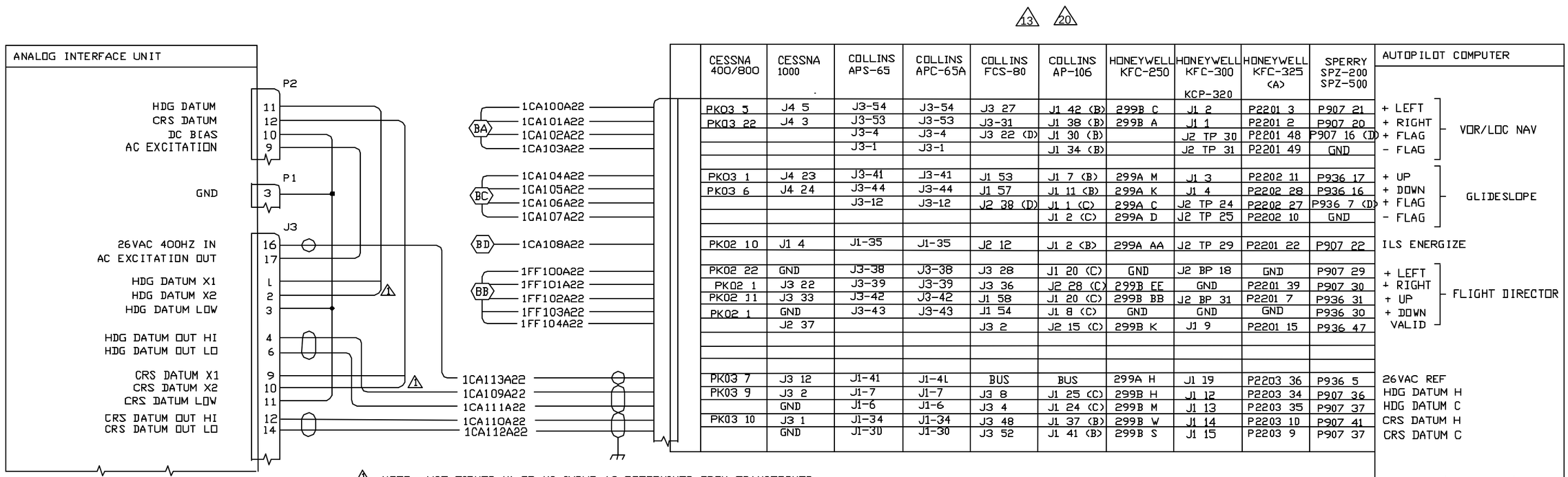

20
VOR/LOC RECEIVER #1
COLLINS VIR-32
APOLLO SL30
HONEYWELL KX-155(A) KX-165(A)
GARMIN GNS-430 GNS-530
HONEYWELL KNS-80
HONEYWELL KNS-81
HONEYWELL KX-170A/B KX-175A/B
HONEYWELL KN-73
HONEYWELL KN-75
COMPOSITE V/L SIGNAL HI | J2 24 (1) | 19 | P401 H | P6 8 | A | D | 3
LO | J2 26 | 37 | SHLD GND | SHLD GND | 1 | E | SHLD GND | | | 1RN1D0A22
ILS ENERGIZE | J2 40 | 33 | P401 8 | P6 29 | 9 | 3 | 4 | | | 1RN1D1B22
G/S FLAG + | J1 9 | 28 | P901 17 | P6 30 | 2 | 8 | | C | B | 1RN1D2B22
G/S FLAG - | J1 13 | 32 | P901 14 | P6 31 | E | 7 | | P | C | 1RN1D3B22
G/S DEV HI | J1 5 | 30 | P901 15 | P6 32 | F | K | | T | 4 | 1RN1D4B22
G/S DEV LO | J1 1 | 31 | P901 16 | P6 31 | E | 7 | | V | 3 | 1RN1D5B22
21
VOR/LOC RECEIVER #2
COLLINS VIR-32
APOLLO SL30
HONEYWELL KX-155(A) KX-165(A)
GARMIN GNS-430 GNS-530
HONEYWELL KNS-80
HONEYWELL KNS-81
HONEYWELL KX-170A/B KX-175A/B
HONEYWELL KN-73
HONEYWELL KN-75
COMPOSITE V/L SIGNAL HI | J2-24 (1) | 19 | P401 H | P6 8 | A | D | 3
LO | J2 26 | 37 | SHLD GND | SHLD GND | 1 | E | SHLD GND | | | 1RN2D0B22
ILS ENERGIZE | J2 40 | 33 | P401 8 | P6 29 | 9 | 3 | 4 | | | 1RN2D1B22
G/S FLAG + | J1 9 | 28 | P901 17 | P6 30 | 2 | 8 | | C | B | 1RN2D2B22
G/S FLAG - | J1 13 | 32 | P901 14 | P6 31 | E | 7 | | P | C | 1RN2D3B22
G/S DEV HI | J1 5 | 30 | P901 15 | P6 32 | F | K | | T | 4 | 1RN2D4B22
G/S DEV LO | J1 1 | 31 | P901 16 | P6 31 | E | 7 | | V | 3 | 1RN2D5B22
NOTE: (1) INSERT A 5UF NON-POLARIZED CAPACITOR BETWEEN VIR-32 J2 PIN 24 AND AIU P1 PIN 37 OR PIN 38
ANALOG INTERFACE UNIT
P1
37 COMPOSITE V/L SIGNAL HI
36 LO
13 ILS ENERGIZE
58 G/S FLAG +
59 G/S FLAG -
54 G/S DEV HI
55 G/S DEV LO
J3
32 G/S FLAG +
33 G/S FLAG -
23 G/S DEV HI
24 G/S DEV LO
38 ILS ENERGIZE
P1
38 COMPOSITE V/L SIGNAL HI
19 LO
14 ILS ENERGIZE
60 G/S FLAG +
61 G/S FLAG -
56 G/S DEV HI
57 G/S DEV LO
J3
34 G/S FLAG +
35 G/S FLAG -
25 G/S DEV HI
26 G/S DEV LO
40 ILS ENERGIZE
AUTOPILOT COMMAND OUT
LT+ 40 1CA10A22
RT+ 39 1CA101A22
+ NAV FLAG 47 1CA102A22
- NAV FLAG 48 1CA103A22
13 AUTOPILOT NAV
FLIGHT DIRECTOR
LT+ 42 1FF100A22
RT+ 43 1FF101A22
UP+ 21 1FF102A22
DN+ 41 1FF103A22
VALID 18 1FF104A22
13 AUTOPILOT FD
GLIDESLOPE SELECT 1/2 45
J3
GLIDESLOPE SELECT 1/2 20
GLIDESLOPE OUT
UP+ 21 1CA104A22
DN+ 22 1CA105A22
+ GS FLAG 30 1CA106A22
- GS FLAG 31 1CA107A22
ILS ENERGIZE 36 1CA108A22
13 AUTOPILOT GLIDESLOPE
13 AUTOPILOT ILS ENERGIZE


RADAR ALTIMETER
HONEYWELL KRA-405B
COLLINS ALT-55B
COLLINS ALT-5D
HONEYWELL KRA-405
13 20
RADAR ALTIMETER FLAG+
P405B1 S
P1 8
P1 8
P405I S
RADAR ALTIMETER SIGNAL HI
P405B1 I
P1 57
P1 57
P405I B
RADAR ALTIMETER SIGNAL LO
P405B1 K
P1 59
P1 59
P405I G
RADAR ALTIMETER TEST
1SA101A22
1SA100A22
1SA102A22
RADALT TEST
S9600
(OPTIONAL)
1SA103A22N
ANALOG INTERFACE UNIT
P1
52 FLAG IN
49 IN
6 GND
RADAR ALTIMETER
ADF SYSTEM
HONEYWELL KR-87
13 20
ADF BRG
SIN A
COS B
DC REF D
1RD102A22
1RD103A22
1RD104A22
P2
14 SIN
15 COS
13 DC REF
ADF SIN/COS
19
ADF SYSTEM
COLLINS RCR-650
COLLINS RCR-650A
13 20
ADF SYNCHRO BRG
SYNCHRO X 9 3
SYNCHRO Y 10 14
SYNCHRO Z 11 15
26V A/C REF P405B1 S P405B1 S
1RD100A22 D
1RD100A22 W
1RD100A22 B
SHLD GND
1RD101A22
SHLD GND
3 X
4 Y
5 Z
8 26VAC REF
ADF ARINC 407
ANNUN PWR
5251
SH 6
1PS111C22
J3
27 DC EXCITATION, BLUE
29 DC EXCITATION, WHITE
42 DC EXCITATION, YELLOW
28 BLUE
44 WHITE
43 YELLOW
13
MARKER RECEIVER
NAT AMS-50-000
PS ENG PMA-6000 PMA-7000
HONEYWELL KMA-26
GARMIN GMA-340
COLLINS VIR-32
HONEYWELL KMA-24
HONEYWELL KMA-20
13 20
MARKER SIGNAL
BLUE J201 C J1 5 P262 14 J1 37 J1 12 5 20
WHITE J201 3 J1 C P262 31 J1 36 J1 16 C 19
YELLOW J201 4 J1 4 P262 15 J1 38 J1 15 4 21
1RM100A22
1RM101A22
1RM102A22
P1
10 BLUE
11 WHITE
12 YELLOW
MARKER BEACON



NOTE: *AN REFERS TO THE OPTIONAL S-TEC ANNUNCIATOR

DC CRS AND HDG DATUM
AUTOPILOT INTERFACE

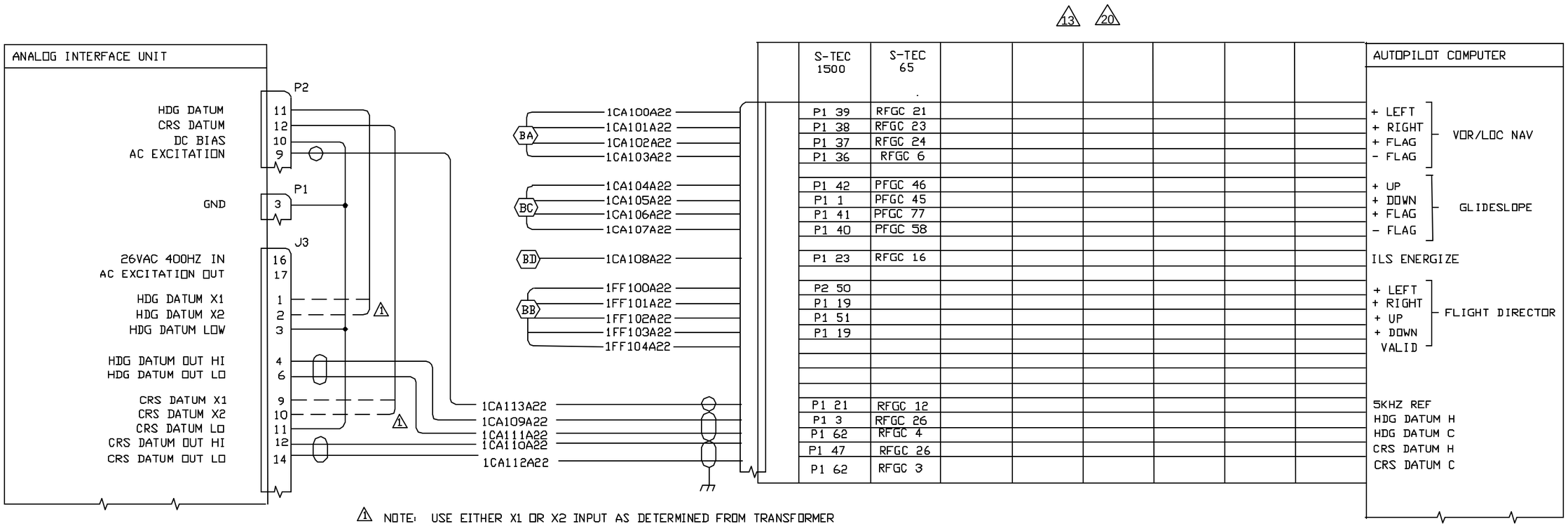


	CESSNA 400/800	CESSNA 1000	COLLINS APS-65	COLLINS APC-65A	COLLINS FCS-80	COLLINS AP-106	HONEYWELL KFC-250	HONEYWELL KFC-300 KCP-320	HONEYWELL KFC-325 (A)	SPERRY SPZ-200 SPZ-500	AUTOPILOT COMPUTER	
	PK03 5	J4 5	J3-54	J3-54	J3 27	J1 42 (B)	299B C	J1 2	P2201 3	P907 21	+ LEFT	VOR/LOC NAV
	PK03 22	J4 3	J3-53	J3-53	J3-31	J1 38 (B)	299B A	J1 1	P2201 2	P907 20	+ RIGHT	
			J3-4	J3-4	J3 22 (D)	J1 30 (B)		J2 TP 30	P2201 48	P907 16 (D)	+ FLAG	
			J3-1	J3-1		J1 34 (B)		J2 TP 31	P2201 49	GND	- FLAG	
	PK03 1	J4 23	J3-41	J3-41	J1 53	J1 7 (B)	299A M	J1 3	P2202 11	P936 17	+ UP	GLIDESLOPE
	PK03 6	J4 24	J3-44	J3-44	J1 57	J1 11 (B)	299A K	J1 4	P2202 28	P936 16	+ DOWN	
			J3-12	J3-12	J2 38 (D)	J1 1 (C)	299A C	J2 TP 24	P2202 27	P936 7 (D)	+ FLAG	
						J1 2 (C)	299A D	J2 TP 25	P2202 10	GND	- FLAG	
	PK02 10	J1 4	J1-35	J1-35	J2 12	J1 2 (B)	299A AA	J2 TP 29	P2201 22	P907 22	ILS ENERGIZE	
	PK02 22	GND	J3-38	J3-38	J3 28	J1 20 (C)	GND	J2 BP 18	GND	P907 29	+ LEFT	FLIGHT DIRECTOR
	PK02 1	J3 22	J3-39	J3-39	J3 36	J2 28 (C)	299B EE	GND	P2201 39	P907 30	+ RIGHT	
	PK02 11	J3 33	J3-42	J3-42	J1 58	J1 20 (C)	299B BB	J2 BP 31	P2201 7	P936 31	+ UP	
	PK02 1	GND	J3-43	J3-43	J1 54	J1 8 (C)	GND	GND	GND	P936 30	+ DOWN	
		J2 37			J3 2	J2 15 (C)	299B K	J1 9	P2201 15	P936 47	VALID	
	PK03 7	J3 12	J1-41	J1-41	BUS	BUS	299A H	J1 19	P2203 36	P936 5	26VAC REF	
	PK03 9	J3 2	J1-7	J1-7	J3 8	J1 25 (C)	299B H	J1 12	P2203 34	P907 36	HDG DATUM H	
		GND	J1-6	J1-6	J3 4	J1 24 (C)	299B M	J1 13	P2203 35	P907 37	HDG DATUM C	
	PK03 10	J3 1	J1-34	J1-34	J3 48	J1 37 (B)	299B W	J1 14	P2203 10	P907 41	CRS DATUM H	
		GND	J1-30	J1-30	J3 52	J1 41 (B)	299B S	J1 15	P2203 9	P907 37	CRS DATUM C	

⚠13 ⚠20

⚠ NOTE: USE EITHER X1 OR X2 INPUT AS DETERMINED FROM TRANSFORMER CALCULATIONS IN CHAPTER 2.
(A) SEE KFC-325 AUTOPILOT INTERFACE IN CHAPTER 2 FOR ADDITIONAL INTERFACE WIRING.
(B) CONNECTED TO 161H-1
(C) CONNECTED TO 913K-1
(D) CONVERT TO SUPER FLAG VIA SF-40 SUPER FLAG CONVERTER OR EQUIVALENT

400HZ AC CRS AND HDG DATUM
AUTOPILOT INTERFACE



5KHZ AC CRS AND HDG DATUM
AUTOPILOT INTERFACE

Chapter 4

AIU Maintenance Utility

The AIU Maintenance Utility allows the installer to modify the analog sensor inputs to the AIU for each aircraft configuration. The program is loaded on a computer that has an RS-232 serial port or a USB to serial port adaptor.

Connect the RS-232 interface cable between the computer and the AIU Maintenance plug. The program can be started before or after power is applied to the AIU.

The Maintenance Utility allows the installer to select or perform the following functions:

- Read stored configuration
- VOR alignment (2 radios)
- LOC alignment (2 radios)
- Radar Altimeter type (ARINC-552A, ALT-50, None)
- ADF DC Sin/Cos type (KR-87 or Wulfsberg)
- Marker Beacon sense polarity
- Marker Beacon voltage threshold
- Autopilot Course datum scaling
- Autopilot Heading datum scaling
- Autopilot datum type (linear or sine)
- Autopilot Heading datum polarity
- Autopilot Course datum polarity
- Autopilot Heading datum null adjustment
- Autopilot Course datum null adjustment
- Flight Director flag polarity
- Flight Director horizontal and vertical scaling
- Flight Director horizontal polarity
- Flight Director vertical polarity
- Flight Director null adjustment

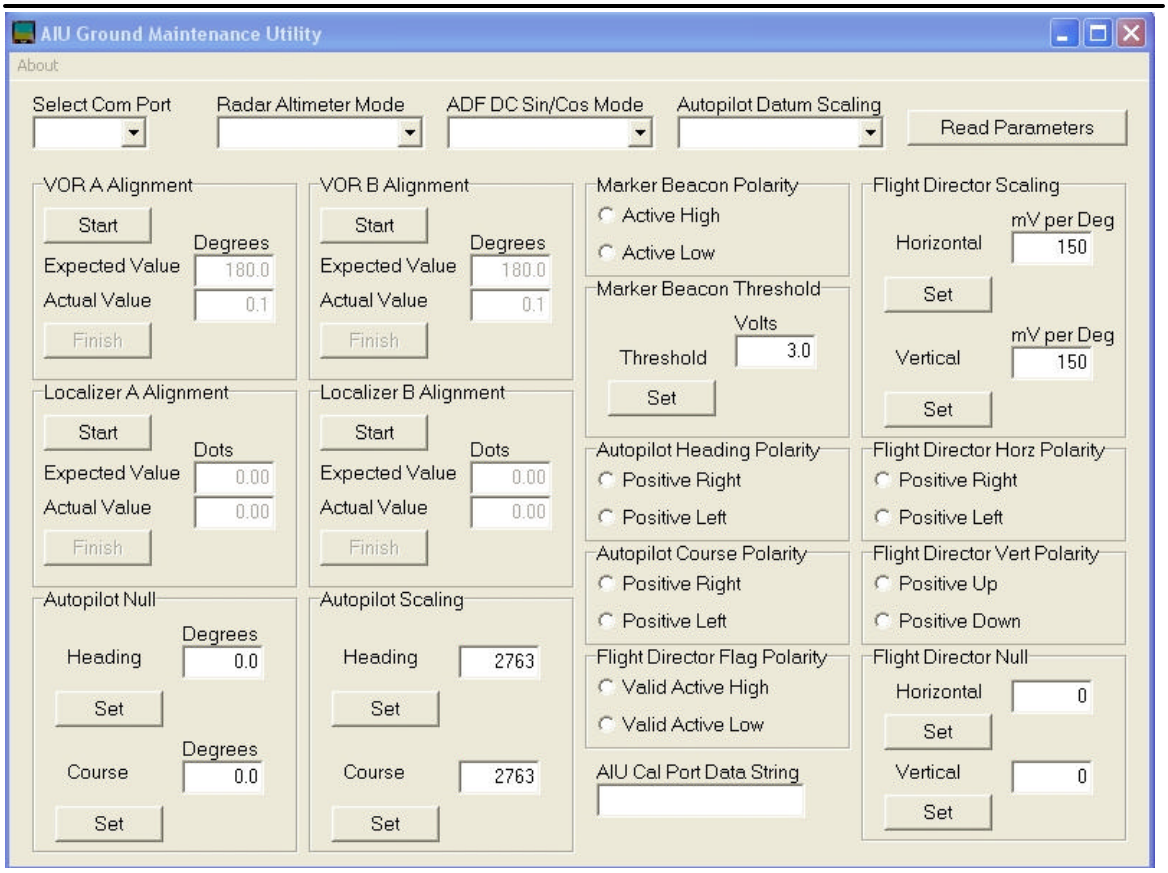


Figure 6. AIU Maintenance Utility Program

Select Com Port
Selects the computers RS-232 communication port that is connected to the AIU. The selections are:

COM1 – Computer com port 1
COM2 – Computer com port 2 (if available)
COM3 – Computer com port 3 (if available)
COM4 – Computer com port 4 (if available)

Radar Altimeter Mode
Selects the type of Radar Altimeter connected to the AIU. The selections are:

ARINC-552A – Radar Altimeter outputs a voltage scale that conforms to ARINC-552A standard
ALT-55 – Radar Altimeter outputs a voltage scale that conforms to Collins ALT-55 standard
None – No Radar Altimeter installed

ADF DC Sin/Cos Mode
Selects the type of DC ADF connected to the AIU. The selections are:

3Sin/3Cos
Disabled

Select "Disabled" for AC (ARINC407 Synchro) ADF receivers.

Autopilot Datum Scaling
Selects the type of scaling that the autopilot Course and Heading datums use. The selections are:

Linear – Linear scale from null point to 90 degrees
Sin – Sinusoidal scale from null point to 90 degrees

Read Parameters
Pressing this button will read the stored parameters in the AIU memory and display the values in the associated boxes.

VOR A Alignment
Allows the installer to align the No1 Nav VOR from the Nav radio. Alignment is described in Chapter 5.

Localizer A Alignment
Allows the installer to align the No1 Nav LOC from the Nav radio. Alignment is described in Chapter 5.

VOR B Alignment
Allows the installer to align the No2 Nav VOR from the Nav radio. Alignment is described in Chapter 5.

Localizer B Alignment
Allows the installer to align the No2 Nav LOC from the Nav radio. Alignment is described in Chapter 5.

Autopilot Scaling
Allows the installer to adjust the Heading and Course datum maximum output voltage from the AIU. This is done in conjunction with an AIU test harness as described in the Ground Test section of this chapter.

Autopilot Null
Allows the installer to adjust the Heading and Course datum null point. This allows the AIU to adjust to autopilots that have a slight amount of null point error. Adjustment is described in Chapter 6.

Marker Beacon Polarity
Selects the active polarity of the Marker Beacon output from the receiver or audio panel. *Active High* is selected when the receiver outputs a voltage above 0 to signal a Marker Beacon light. *Active Low* is selected when the receiver provides a ground to signal a Marker Beacon light. Selecting *Active Low* requires an external voltage source and pull-up resistors as shown in the wiring diagram options.

Marker Beacon Threshold
Sets the voltage for the AIU to determine a valid Marker Beacon condition. The selection of the *Marker Beacon Polarity* will determine if the valid state is above or below the threshold level.

Autopilot Heading Polarity
Selects the polarity of the AIU Heading Datum output to the autopilot. Selecting *Positive Right* will cause the AIU to send a positive DC voltage or a positive Sine angle to the autopilot when the heading bug is right of the EFIS heading indicator. Selecting *Positive Left* will cause the AIU to send a positive DC voltage or a positive Sine angle to the autopilot when the heading bug is left of the EFIS heading indicator.

Autopilot Course Polarity
Selects the polarity of the AIU Course Datum output to the autopilot. Selecting *Positive Right* will cause the AIU to send a positive DC voltage or a positive Sine angle to the autopilot when the HSI source OBS is right of the EFIS heading indicator. Selecting *Positive Left* will cause the AIU to send a positive DC voltage or a positive Sine angle to the autopilot when the HSI source OBS is left of the EFIS heading indicator.

Flight Director Flag Polarity
Selects the polarity of the Flight Director Valid Flag from an Autopilot or Flight Director Computer if applicable. Selecting *Valid Active High* will cause the AIU to send the Flight Director vertical and horizontal commands to the EFIS when the Flight Director Valid is above 3VDC. Selecting *Valid Active Low* will cause the AIU to send the Flight Director vertical and horizontal commands to the EFIS when the Flight Director Valid is below 1VDC.

Flight Director Scaling
The Horizontal scaling box allows the installer to set the value of the Flight Director horizontal signal in mV per Degree. Upon setting the value in the box, the installer will press the “Set” button below the box to store the value in the AIU memory.

The Vertical scaling box allows the installer to set the value of the Flight Director vertical signal in mV per Degree. Upon setting the value in the box, the installer will press the "Set" button below the box to store the value in the AIU memory.

Flight Director Horz Polarity
Selects the polarity of the Flight Director horizontal deviation signal to the AIU. Selecting *Positive Right* will cause the AIU to send a right deviation to the EFIS when the horizontal deviation is positive. Selecting *Positive Left* will cause the AIU to send a left deviation to the EFIS when the horizontal deviation is positive.

Flight Director Vert Polarity
Selects the polarity of the Flight Director vertical deviation signal to the AIU. Selecting *Positive Up* will cause the AIU to send an up deviation to the EFIS when the vertical deviation is positive. Selecting *Positive Down* will cause the AIU to send a down deviation to the EFIS when the vertical deviation is positive.

Flight Director Null
The Horizontal null box allows the installer to center the horizontal deviation on the EFIS when the Flight Director horizontal command is centered. Upon selecting the value in the box, the installer will press the "Set" button below the box to store the value in the AIU memory.

The Vertical null box allows the installer to center the vertical deviation on the EFIS when the Flight Director vertical command is centered. Upon selecting the value in the box, the installer will press the "Set" button below the box to store the value in the AIU memory.

AIU Cal Port Data String
The data displayed in this box is real-time from the AIU.

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Chapter 5

Ground Functional Test

		PASS	FAIL

1.0 PURPOSE OF TEST:

1.1 The procedures defined in this plan will demonstrate the proper operation of the AIU as installed on aircraft.

2.0 TEST EQUIPMENT REQUIRED:

2.1 Navigation Flight Line Tester IFR-401 or equivalent
Laptop computer with AIU Maintenance program
RS-232 Serial cable
Pilots Guide and Reference

3.0 AIU STRUCTURAL TEST

3.1 Structure test of AIU mounting shelf as described in Chapter 2, Task 2. _____ _____

4.0 AIU SWITCH SETTINGS

4.1 Verify settings for S1 and S2 positions 1 and 2 are correct for AC or DC operations as described in Chapter 2, Autopilot Interface. _____ _____

4.2 Verify settings for S2 positions 3 thru 5 are correct for Heading Datum Gain as described in Chapter 2, Autopilot Interface. _____ _____

4.3 If required, verify settings for S2 positions 6 thru 8 are correct for Course Datum Gain as described in Chapter 2, Autopilot Interface. _____ _____

5.0 AIU WIRING TEST:

5.1 Do not connect any equipment connectors until the following steps have been completed, prior to applying power to the AIU.

		PASS	FAIL
5.2	Verify the wiring. Each wire should be continuity checked as indicated on drawing 702-045250 and 702-045251.	_____	_____
5.3	All shield wire, shielded twisted pairs and shielded twisted triple cables should be checked for shorts to the shield.	_____	_____
5.4	Apply aircraft 14 or 28 Volt DC power (as applicable). Place the EFIS Master or Avionics Master switch to ON.		
	Verify that the proper voltage is on the proper pin.		
	AIU Connector P2 Pins 1,6	_____	_____
	AIU Connector J3 Pin 18 or 19	_____	_____
5.5	Place the EFIS Master or Avionics Master switch to OFF and remove aircraft 14 or 28V DC power.		
5.6	At this time, install the AIU connector and push in all related circuit breakers.		

6.0 POWER UP EFIS SYSTEM TEST:

NOTE: Verify that all EFIS circuit breakers are pushed in.

6.1	Apply aircraft 14 or 28 Volt DC power (as applicable). Place the EFIS Master or Avionics Master switch to ON.		
6.2	Allow the EFIS to perform the self-test routine and verify the IDUs are displaying the correct page.	_____	_____
6.3	Verify that the "AUX SENSOR" flag is not present on either the PFD or MFD(s).	_____	_____
	NOTE: Depending on aircraft location, other flags such as "NO GPS" might be present on the EFIS. Determine the cause of any additional flags and correct accordingly.		
6.4	From the MFD, press the *MENU* button then select "FAULTS" menu. Verify that the "AIU" is labeled "OK."	_____	_____
6.5	Press the *MENU* button again to exit the submenu.		

7.0 NAV1 TEST:

		PASS	FAIL
7.1	If installed, tune the No1 Nav receiver to the Flight Line tester VOR test frequency.	_____	_____
7.2	Turn on the test set and select the VOR output with a signal level of -100dBm.	_____	_____
7.3	Select the "HSI" format on the MFD.	_____	_____
7.4	Turn on the RMI function on the MFD.	_____	_____
7.5	Set the HSI source to Nav 1.	_____	_____
7.6	Verify that the green "HSI: NAV1" flag is displayed on the lower left-hand corner of the PFD and MFD(s).	_____	_____
7.7	Connect Laptop computer with AIU Maintenance program to AIU Maintenance connector. Turn on computer and start the program.		
7.8	Verify that the VOR needle on the HSI is not present (flagged).	_____	_____
7.9	Increase the test set signal level until the Nav1 needle is displayed.	_____	_____
7.10	Set the VOR dial on the test set to the aircraft heading on the EFIS, and set the "VOR OBS" to the aircraft heading. Verify CDI needle is within a dot of center.	_____	_____
7.11	Set the VOR dial on the test set to a heading of 180 and direction to TO. Select the "VOR OBS," and then rotate the right-hand encoder until the OBS is at 180 degrees. Verify the needle on the HSI moves to 180 ±3 degrees.	_____	_____
7.12	Press the VOR A Alignment *START* button in the AIU Maintenance program. Highlight the "Expected Value" box and type 180.0. Highlight the "Actual Value" box and type the value of the CDI needle into the box. Press the *FINISH* button and verify the CDI needle is centered.	_____	_____
7.13	Set the VOR direction to FROM and verify the CDI needle pointer is pointing to 360 degrees and the needle is centered.	_____	_____

		PASS	FAIL
7.14	Set the VOR dial on the test set to a heading of 90.0 and direction to TO. Select the "VOR OBS," and then rotate the right-hand encoder until the OBS is at 90 degrees. Verify the needle on the HSI moves to 90 ±3 degrees.	_____	_____
7.15	Set the VOR dial on the test set to a heading of 360.0. Select the "NAV OBS," and then rotate the right-hand encoder until the OBS is at 360 degrees. Verify the needle on the HSI moves to 360 ±3 degrees.	_____	_____
7.16	Set the VOR dial on the test set to a heading of 270.0. Select the "VOR OBS," and then rotate the right-hand encoder until the OBS is at 270 degrees. Verify the needle on the HSI moves to 270 ±3 degrees.	_____	_____
7.17	Set the No1 Nav receiver to the test set ILS frequency. Tune the test set to the ILS frequency and select a 0 degree LOC and 0 degree GS.	_____	_____
7.18	Verify the CDI needle is centered and the GS bar is at 0 on the HSI. Verify CDI is centered on the flight path marker and GS bar is at 0 on the PFD.	_____	_____
7.19	Press the Localizer A Alignment *START* button in the AIU Maintenance program. Highlight the "Expected Value" box and type 0.00. Highlight the "Actual Value" box and type in the CDI deviation in dot (Right =+) as displayed on the HSI. Press the *FINISH* button and verify the CDI needle is centered.	_____	_____
7.20	Set the test set for a standard deflection right (0.093DDM) LOC and verify the CDI needle on the HSI is deflected between 1.0 and 1.2 Dot right. Verify the CDI needle is between 1.0 and 1.2 Dot right of the flight path marker on the PFD.	_____	_____
7.21	Set the test set for a full scale deflection right (0.155DDM) LOC and verify the CDI needle on the HSI is deflected between 1.8 and 2.0 Dots right. Verify the CDI is between 1.8 and 2.0 Dots right of the flight path marker on the PFD.	_____	_____

		PASS	FAIL
7.22	Set the test set to a 90 Hz only tone LOC and verify the CDI needle on the HSI and the CDI needle on the PFD are removed.	_____	_____
7.23	Set the test set for a standard deviation left (0.093DDM) LOC and verify the CDI needle on the HSI is deflected between 1.0 and 1.2 Dots left. Verify the CDI needle is between 1.0 and 1.2 Dots left of the flight path marker on the PFD.	_____	_____
7.24	Set the test set for a full scale deflection left (0.155DDM) LOC and verify the CDI needle on the HSI is deflected between 1.8 and 2.0 Dots left. Verify the CDI needle is between 1.8 and 2.0 Dots left of the flight path marker on the PFD.	_____	_____
7.25	Set the test set to a 150 Hz only tone and verify the CDI needle on the HSI and the CDI needle on the PFD are removed.	_____	_____
7.26	Set the test set to 0 degrees LOC. Verify the CDI needle on the HSI is centered. Verify the CDI needle is centered on the flight path marker on the PFD.	_____	_____
7.27	Set the test set for a standard deviation down (0.091DDM) GS and verify the GS bar on the HSI is one-dot down. Verify the GS bar is one dot down on the PFD.	_____	_____
7.28	Set the test set for a full scale deviation down (0.175DDM) GS and verify the GS bar on the HSI is full deflection down. Verify the GS bar is two dots down on the PFD.	_____	_____
7.29	Set the test set to a 150 Hz only tone GS and verify that the GS bar is removed on the HSI and the GS bar is removed from the PFD.	_____	_____
7.30	Set the test set for a standard deviation up (0.091DDM) GS and verify the GS bar on the HSI is one-dot up. Verify the GS bar is one dot up on the PFD.	_____	_____
7.31	Set the test set for a full scale deviation up (0.175DDM) GS and verify the GS bar on the HSI is full deflection up. Verify the GS bar is two dots up on the PFD.	_____	_____

		PASS	FAIL
7.32	Set the test set to a 90 Hz only tone GS and verify that the GS bar is removed on the HSI and the GS bar is removed on the PFD.	_____	_____
7.33	Reset the test set to a centered deflection (0DDM) GS and verify that the GS bar on the HSI is centered and the CDI bar on the PFD is centered.	_____	_____
8.0	**NAV2 TEST:**		
8.1	If installed, tune the No2 Nav receiver to the Flight Line tester VOR test frequency	_____	_____
8.2	Turn on the test set and select the VOR output with a signal level of -100dBm.	_____	_____
8.3	Set the HSI to Nav 2.	_____	_____
8.4	Verify that the green "HSI: NAV2" flag is displayed on the lower left-hand corner of the PFD and MFD(s).	_____	_____
8.5	Verify that the VOR needle on the HSI is flagged.	_____	_____
8.6	Increase the test set signal level until the Nav2 needle is displayed.	_____	_____
8.7	Set the VOR dial on the test set to the aircraft heading on the EFIS. Select the "VOR OBS," and then rotate the right-hand encoder until the OBS is in line with aircraft heading. Verify CDI needle is within a dot of center.	_____	_____
8.8	Set the VOR dial on the test set to a heading of 180 and direction to TO. Select the "VOR OBS," and then rotate the right-hand encoder until the OBS is at 180 degrees. Verify the needle on the HSI moves to 180 ±3 degrees.	_____	_____
8.9	Press the VOR B Alignment *START* button in the AIU Maintenance program. Highlight the "Expected Value" box and type 180.0. Highlight the "Actual Value" box and type the value of the CDI needle into the box. Press the *FINISH* button and verify the CDI needle is centered.	_____	_____

		PASS	FAIL
8.10	Set the VOR direction to FROM and verify the CDI needle pointer is pointing to 360 degrees and the needle is centered.	_____	_____
8.11	Set the VOR dial on the test set to a heading of 90.0 and direction to TO. Select the "VOR OBS," and then rotate the right-hand encoder until the OBS is at 90 degrees. Verify the needle on the HSI moves to 90 ±3 degrees.	_____	_____
8.12	Set the VOR dial on the test set to a heading of 360.0. Select the "VOR OBS," and then rotate the right-hand encoder until the OBS is at 360 degrees. Verify the needle on the HSI moves to 360 ±3 degrees.	_____	_____
8.13	Set the VOR dial on the test set to a heading of 270.0. Select the "VOR OBS," and then rotate the right-hand encoder until the OBS is at 270 degrees. Verify the needle on the HSI moves to 270 ±3 degrees.	_____	_____
8.14	Set the No2 Nav receiver to the test set ILS frequency. Tune the test set to the ILS frequency and select a 0 degree LOC and 0 degree GS.	_____	_____
8.15	Verify the CDI needle is centered and the GS bar is at 0 on the HSI. Verify CDI needle is centered to the flight path marker and the GS bar is at 0 on the PFD.	_____	_____
8.16	Press the Localizer B Alignment *START* button in the AIU Maintenance program. Highlight the "Expected Value" box and type 0.00. Highlight the "Actual Value" box and type in the CDI deviation in dot (Right =+) as displayed on the HSI. Press the *FINISH* button and verify the CDI needle is centered.	_____	_____
8.17	Set the test set for a standard deflection right (0.093DDM) LOC and verify the CDI needle on the HSI is deflected between 1.0 and 1.2 Dot right. Verify the CDI needle is between 1.0 and 1.2 Dot right of the flight path marker on the PFD.	_____	_____

		PASS	FAIL
8.18	Set the test set for a full scale deflection right (0.155DDM) LOC and verify the CDI needle on the HSI is deflected between 1.8 and 2.0 Dots right. Verify the CDI needle is between 1.8 and 2.0 Dots right of the flight path marker on the PFD.	_____	_____
8.19	Set the test set to a 90 Hz only tone LOC and verify the CDI needle on the HSI and the CDI needle on the PFD are removed.	_____	_____
8.20	Set the test set for a standard deviation left (0.093DDM) LOC and verify the CDI needle on the HSI is deflected between 1.0 and 1.2 Dot left. Verify the CDI needle is between 1.0 and 1.2 Dot left of the flight path marker on the PFD.	_____	_____
8.21	Set the test set for a full scale deflection left (0.155DDM) LOC and verify the CDI needle on the HSI is deflected between 1.8 and 2.0 Dots left. Verify the CDI needle is between 1.8 and 2.0 Dots left of the flight path marker on the PFD.	_____	_____
8.22	Set the test set to a 150 Hz only tone and verify the CDI needle on the HSI and the CDI needle on the PFD are removed.	_____	_____
8.23	Set the test set to 0 degrees LOC. Verify the CDI needle on the HSI is centered. Verify the CDI needle is centered on the flight path marker on the PFD.	_____	_____
8.24	Set the test set for a standard deviation down (0.091DDM) GS and verify the GS bar on the HSI is one-dot down. Verify the GS bar is one dot down on the PFD.	_____	_____
8.25	Set the test set for a full scale deviation down (0.175DDM) GS and verify the GS bar on the HSI is full deflection down. Verify the GS bar is two dots down on the PFD.	_____	_____
8.26	Set the test set to a 150 Hz only tone GS and verify that the GS bar is removed on the HSI and PFD.	_____	_____
8.27	Set the test set for a standard deviation up (0.091DDM) GS and verify the GS bar on the HSI is one-dot up. Verify the GS bar is one dot up on the PFD.	_____	_____

		PASS	FAIL
8.28	Set the test set for a full scale deviation up (0.175DDM) GS and verify the GS bar on the HSI is full deflection up. Verify the GS bar is two dots up on the PFD.	_____	_____
8.29	Set the test set to a 90 Hz only tone GS and verify that the GS bar on the HSI and PFD are removed.	_____	_____
8.30	Reset the test set to a centered deflection (0DDM) GS and verify that the GS bar on the HSI and PFD are centered.	_____	_____

9.0 MARKER BEACON TEST:

9.1	Set the polarity of the Marker Beacon by selecting the "Active High" or "Active Low" buttons on the AIU Maintenance program. "Active High" is used when a Marker Beacon receiver outputs a voltage to signal a valid beacon condition. "Active Low" is used when a Marker Beacon receiver outputs a ground to signal a valid beacon condition. Consult the Marker Beacon receiver or Audio Panel Installation Manual for details.		
9.2	Set the threshold of the Marker Beacon by highlighting the "Volts" box on the AIU Maintenance program and setting the threshold to determine a valid condition. If Marker Beacon polarity is set to "Active High," any voltage above this level will be considered a valid condition. If Marker Beacon polarity is set to "Active Low," any voltage below this level will be considered a valid condition. Default value is 3.0 Volts.		
9.3	If the Marker Beacon is interfaced with the AIU, tune the Nav test set to the Marker Beacon frequency.		
9.4	Select the 400 Hz output and verify that the blue circle with "O" on the lower-center of the PFD.	_____	_____
9.5	Select the 1300 Hz output and verify that the amber circle with "M" on the lower-center of the PFD.	_____	_____
9.6	Select the 3000 Hz output and verify that the white circle with "I" on the lower-center of the PFD is.	_____	_____

10.0 ADF TEST:

10.1	Select the "MAP" format.	_____	_____

		PASS	FAIL
10.2	If interfaced with a DC ADF output, select the 3Sin/3Cos mode in the AIU Maintenance program. **NOTE:** ARINC-407 XYZ ADF does not require a selection.	_____	_____
10.3	Tune the ADF receiver to three or four different stations and verify that the ADF needle on the MFD RMI points in the direction of the station within 5 degrees.	_____	_____
10.4	Press the test button on the ADF receiver as applicable and verify the ADF needle on the HSI performs the test function as described in the receiver installation/maintenance manual.	_____	_____
10.5	Tune the ADF receiver to an off frequency or turn off the ADF receiver and verify that the ADF needle on the RMI is removed.	_____	_____

11.0 RADAR ALTIMETER TEST:

11.1	Select the type of Radar Altimeter from the "Radar Altimeter Mode" pull-down box on the AIU Maintenance program.		
11.2	Verify that the altitude next to the flight path marker on the PFD is reading "0R."	_____	_____
11.3	Press the Radar Altimeter test button and verify that the altitude next to the flight path marker on the PFD increases to the test altitude as detailed in the test section of the Radar Altimeter installation/maintenance manual.	_____	_____
11.4	Release the Radar Altimeter test button and verify that the altitude next to the flight path marker on the PFD returns to "0R."	_____	_____

12.0 AUTOPILOT AND FLIGHT DIRECTOR TEST:

		PASS	FAIL
12.1	Using the Autopilot manufacturers Installation Manual, program the following information into the AIU Maintenance program: Autopilot Heading Polarity Positive Left/ Positive Right Autopilot Course Polarity Positive Left/ Positive Right Flight Director Flag Polarity Active High/ Active Low Flight Director Horz Polarity Positive Left/ Positive Right Flight Director Vert Polarity Positive Up/ Positive Down		
12.2	Program the Autopilot Scaling for Course and Heading Datums as defined in the Chapter 2, Autopilot Interface.		
12.3	Program the Flight Director Scaling for Vertical and Horizontal deviation from the Autopilot Manufacturers Installation Manual.		

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Chapter 6

Flight Functional Test

1.0 GENERAL

1.1 REFERENCE DOCUMENTS

Note: The following documents should be readily available during testing.

DOCUMENT	VENDOR	DOCUMENT NUMBER	REV.
PILOTS GUIDE	Chelton Flight Systems	150-045240	
AUTOPILOT OPERATION MANUAL	MISC.		

2.0 PURPOSE

2.1 To conduct a functional flight test, to evaluate / verify proper operation and accuracy of the multi-sensor, Chelton EFIS System, including operational functions, transfer functions, switching functions, and electrical bus switching, pertaining to the EFIS installation.

		PASS	FAIL

3.0 FLIGHT TEST:

NOTE: All test flights should be conducted in day VFR conditions away from traffic as needed.

NOTE: The aircraft's autopilot must be aligned per the autopilot manufacturers Installation Manual prior to flight.

3.1 Connect a Laptop computer with AIU Maintenance program to the AIU Maintenance connector. Apply power to the laptop and launch the program

3.2 Trim the aircraft for straight and level flight with little or no turbulence.

		PASS	FAIL

4.0 HEADING AND COURSE NULL:

4.1 Set the heading bug on the EFIS to the aircrafts heading and engage the autopilot in heading mode.

4.2 Allow a 5 minute flight without changing any controls. Determine if the Heading Datum requires alignment. If heading needs adjustment, select the "HEADING" box in the Autopilot Null section and type in the degrees of change required (Right = +), then press the *SET* button. _____ _____

4.3 Allow another 5 minute flight without changing any controls and determine if additional adjustments are required. Repeat step 4.2 until heading is nulled.

4.4 Tune the No1 Nav radio to a VOR station and fly to the station. Set the NAV OBS to the station bearing.

4.5 Set the autopilot in NAV mode and allow a 5 minute flight without changing any controls. Determine if the Course Datum requires alignment. If course needs adjustment, select the "COURSE" box in the Autopilot Null section and type in the degrees of change required (Right = +), then press the *SET* button. _____ _____

4.6 Allow another 5 minute flight without changing any controls and determine if additional adjustments are required. Repeat step 4.5 until course is nulled.

5.0 FLIGHT DIRECTOR NULL: (IF APPLICABLE)

5.1 Place the autopilot in heading mode and set the heading bug on the EFIS to the aircraft heading.

5.2 If installed, select the autopilot flight director and verify the command bars are present on the PFD over the flight path marker in magenta. _____ _____

5.3 With the aircraft flying straight and level, verify the command bars intersect in the center of the flight path marker. If alignment is required, perform the following steps. _____ _____

		PASS	FAIL
5.4	Determine if the horizontal command bar is off center. Select the "Horizontal" box in the Flight Director Null section of the AIU Maintenance program and type in the degree of offset to null the command bar (Right =+)	_____	_____
5.5	Maintain flight and determine if additional adjustment is needed. Repeat step 5.4 as required.		
5.6	Determine if the vertical command bar is off center. Select the "Vertical" box in the Flight Director Null section of the AIU Maintenance program and type in the degree of offset to null the command bar (Up =+).	_____	_____
5.7	Maintain flight and determine if additional adjustment is needed. Repeat step 5.6 as required.		

6.0 HEADING GAIN:

6.1	Activate the Heading Bug on the EFIS and set the autopilot in the Heading mode. Center the Heading Bug to the aircraft heading.		
6.2	Move the Heading Bug off the aircraft heading by 10º and evaluate the capture of the new heading.		
6.3	If the aircraft undershoots the bug (stops short) or is slow to capture, increase the gain by selecting the "Heading" box in the AIU Maintenance program and increase the value.		
6.4	If the aircraft overshoots the bug or is too fast, decrease the gain by selecting the "Heading" box in the AIU Maintenance program and decrease the value.		
6.5	Repeat steps 6.2 through 6.4 until the aircraft captures the heading bug in an acceptable manner.		
6.6	Fly an IFR or VFR approach as programmed in the EFIS (with HITS boxes) with the Heading Bug off and the autopilot in the Heading mode, and verify the autopilot keeps the aircraft within the boxes.	_____	_____

7.0 COURSE GAIN:

7.1	Set the Nav source on the EFIS to Nav1 or Nav2.		

		PASS	FAIL

7.2 Set the Nav radio to a VOR station frequency and set the autopilot in the Nav mode.

7.3 Fly to the VOR station and set the Nav OBS on the EFIS to the radial flown. Verify the CDI needle on the EFIS is centered.

7.4 Select the Nav OBS on the EFIS and adjust for a 10º offset. Verify the autopilot flys the aircraft past the CDI needle, then back to center the CDI needle for one cycle.

7.5 If the aircraft overshoots the CDI needle too far, takes more than one cycle to center the needle, or the autopilot bank command is too fast, then decrease the gain by selecting the "Course" box in the AIU Maintenance program and decrease the value.

7.6 If the aircraft undershoots the CDI needle, takes less than one cycle to center the needle, or the autopilot bank command is two slow, then increase the gain by selecting the "Course" box in the AIU Maintenance program and increase the value.

7.7 Repeat steps 7.3 thru 7.6 until the aircraft centers on the CDI needle in one cycle in an acceptable manner. _____ _____

7.8 Fly an IFR or VFR approach as programmed in the EFIS (with HITS boxes) with the Heading Bug off and the autopilot in the Nav mode and verify the autopilot keeps the aircraft within the boxes. _____ _____

End of Flight Test

Chapter 7

Troubleshooting

The following table provides additional information for the repairman to troubleshoot and repair the AIU installation.

PROBLEM	CAUSE	SOLUTION
IDU displays "AUX SENSOR" flag and the "AIU" is failed in the *FAULTS* menu.	1. Defective wiring to AIU	1a. Verify AIU circuit breaker is in. Reset breaker. 1b. Verify power is present on AIU J2 pins 1 and 6. Repair wiring as necessary. 1c. Verify continuity between AIU J2 pins 2 and 7 and airframe ground. Repair wiring as necessary. 1d. Verify communication wires from AIU to IDU(s) are correct and not shorted to each other or ground. Repair wiring as necessary.
AIU does not communicate with laptop computer	1. Defective wiring to AIU Maintenance connector 2. Laptop Com port discrepancy	1. Verify communication wires from AIU to AIU Maintenance connector are correct and not shorted to each other or ground. Repair wiring as necessary. 2a. Ensure that power management functions of the laptop computer are disabled. 2b. Ensure any programs on the laptop do not conflict with the AIU Maintenance program for Com port assignment.
Nav1 or Nav2 VOR is out of spec. on the EFIS	1. Nav radio 2. VOR alignment	1. Verify the Nav receiver is within spec for composite VOR. Repair radio as necessary. 2. Perform VOR alignment procedure from AIU Maintenance program for defective Nav.
Nav1 or Nav2 LOC is out of spec. on the EFIS	1. Nav radio 2. LOC alignment	1. Verify the Nav receiver is within spec for composite LOC. Repair radio as necessary. 2. Perform LOC alignment procedure

PROBLEM	CAUSE	SOLUTION
		from AIU Maintenance program for defective Nav.
Autopilot always flies No1 Glideslope	1. Wiring error	1a. Verify wiring from Glideslope receivers to the AIU P1 and J3 are correct. Repair wiring as necessary. 1b. Verify Glideslope Select wire from AIU P1 pin 45 is connected to AIU J3 pin 20. Repair wire as necessary. 1c. Verify wiring from AIU J3 to Autopilot is correct. Repair wiring as necessary.
Radar Altimeter is not displayed on the EFIS	1. Radar Altimeter mode 2. Wiring error	1. Verify the Radar Altimeter Mode is set correctly in the AIU Maintenance program. 2. Verify wiring from Radar Altimeter is connected properly to the AIU. Repair wiring as necessary.
ADF is not displayed or is wrong on the EFIS	1. ADF mode 2. Wiring error	1. Verify the ADF DC Sin/Cos Mode is properly selected in the AIU Maintenance program. "3Sin/3Cos" for DC input, "None" for ARINC-407 XYZ input. 2. Verify wiring from the ADF receiver is connected properly to the AIU. Repair wiring as necessary.
Marker Beacon is not displayed on the EFIS	1. MB setting 2. Wiring error	1a. Verify that the Marker Beacon Polarity is set for the type of input in the AIU Maintenance program. Set the polarity as necessary. 1b. Verify that the Marker Beacon Threshold is set for the type of input in the AIU Maintenance program. Set the threshold as necessary. 2. Verify the wiring from the Marker Beacon receiver is connected properly to the AIU. Repair wiring as necessary.
Marker Beacon light always displayed on the EFIS	1. AIU Maintenance programming	1. Verify threshold and polarity in AIU Maintenance program is set correctly.

PROBLEM	CAUSE	SOLUTION
	2. MB excitation	2. Verify excitation voltage is present on AIU P3, pins 27, 29, and 42 for active low Marker Beacon.
Autopilot heading does not function or is backwards	1. Wiring error	1a. Verify the wiring from the Heading Datum output of the AIU is correct for the type of heading input to the autopilot (DC, 400Hz, and 5KHz). Repair wiring as necessary. 1b. Verify interconnect wiring between AIU P2 and J3 is correct for the type of Heading Datum (400Hz, 5KHz). Repair wiring as necessary. 1c. Verify the DC Bias or AC Excitation is properly wired from the autopilot or AC source to the AIU. Repair wiring as necessary.
	2. AIU Maintenance programming	2. Verify the Autopilot Heading Polarity is correct for the autopilot requirements. Select the proper polarity as required.
Autopilot heading is not centered	1. AIU Maintenance programming	1. Set the Autopilot Heading Null per Chapter 6, Step 4.0 thru 4.3 as required.
Autopilot overshoots or undershoots the Heading Bug	1. AIU Maintenance programming	1. Perform the Heading Gain alignment per Chapter 6, Steps 6.1 thru 6.6 as required.
Autopilot course does not function or is backwards	1. Wiring error	1a. Verify the wiring from the Course Datum output of the AIU is correct for the type of Course input to the autopilot (DC, 400Hz, and 5KHz). Repair wiring as necessary. 1b. Verify interconnect wiring between AIU P2 and J3 is correct for the type of Course Datum (400Hz, 5KHz). Repair wiring as necessary. 1c. Verify the DC Bias or AC Excitation is properly wired from the autopilot or AC source to the AIU. Repair wiring as necessary.
	2. AIU Maintenance programming	2. Verify the Autopilot Course Polarity is correct for the autopilot requirements. Select the proper

PROBLEM	CAUSE	SOLUTION
		polarity as required.
Autopilot Course is not centered	1. AIU Maintenance programming	1. Set the Autopilot Course Null per Chapter 6, Step 4.4 thru 4.6 as required.
Autopilot Course is sluggish	1. AIU Maintenance programming	1. Set the Course Scale to the same value as the Heading Scale per Chapter 6, Step 7.1 as required.
Flight Director does not display on EFIS	1. EFIS Setup 2. Wiring error 3. AIU Maintenance programming	1. Verify "FD" is selected on the EFIS PFD declutter menu. 2. Verify wiring from the Autopilot to the AIU is correct. Repair wiring as necessary. 3. Verify the Flight Director Flag Polarity is properly set if applicable on the AIU Maintenance program. Select the proper polarity for the FD Valid flag.
Flight Director command bar scaling is not correct vertically or horizontally on the EFIS	1. AIU Maintenance programming	1. Verify the Horizontal and Vertical scales are set properly for the Autopilot or Flight Director computer output. Set the proper values in mV per Degree.
Flight Director command bars are not centered on the EFIS	1. AIU Maintenance programming	1. Set the Flight Director Null values for horizontal and/or vertical as required to center the FD command bars on the EFIS when the Autopilot or Flight Director Computer is in a centered condition.
Flight Director horizontal command bars are backwards on the EFIS	1. Wiring error 2. AIU Maintenance programming	1. Verify the Left/Right wires from the Autopilot or Flight Director Computer are wired correctly to the AIU. Rewire as necessary. 2. Verify the Flight Director Horz Polarity is set correctly in the AIU Maintenance program. Set the proper polarity.
Flight Director vertical command bars are backwards on the EFIS	1. Wiring error 2. AIU Maintenance programming	1. Verify the Up/Down wires from the Autopilot or Flight Director Computer are wired correctly to the AIU. Rewire as necessary. 2. Verify the Flight Director Vert Polarity is set correctly in the AIU

PROBLEM	CAUSE	SOLUTION
		Maintenance program. Set the proper polarity.